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Subterranea

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In This Issue

RAF Boulmer

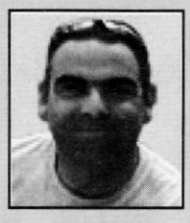
Uxbridge AAOR

Iron Mountain

Books, News and Reviews

The Newsletter of Subterranea Britannica and The Cold War Research Study Group.
www.subbrit.org.uk

Subterranea Britannica is a society devoted to the study of man-made and man-used, underground structures and the archaeology of the Cold War. The main focus of interest is on abandoned and forgotten structures and, in the case of Cold War structures, studies are entirely confined to declassified and decommissioned structures.
The society is open to all and its membership includes all walks of life. Members are invited to contribute to this newsletter even if this just means sending very welcome snippets from newspapers and magazines.



I have decided to stand down as editor of Subterranea. In my time as editior I have produced two editions of the Newsletter, three editions of Siren and more recently eight editions of Subterranea. Due to work commitments and other projects the time has come to hang up my keyboard. This edition is absolutley my last!

I will leave you with this bumper 70 page issue of Subterranea, I hope you enjoy it.
Many Thanks - Dan McKenzie

The committee is looking for a new editor, this could be you, do you have DTP skills? Access to a PC or Mac, with DTP Software? Fancy a challenge?

Please contact a member of the committee if you would like to apply.

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Front and rear cover images are from a recent trip to Sevastopol in Ukraine a full article will appear in the next edition of Subterranea - Photos Copyright Dan McKenzie and Mark Bennett

Newsletters of Subterranea Britannica are published by the committee of Subterranea Britannica. Original articles , book reviews, press cuttings, extracts from books and journals, letters to the editor etc. are welcome. However the editor reserves the right not to publish material without giving a reason.
The committee of Subterranea Britannica and the editor do not necessarily agree with any views expressed and cannot check the accuracy of any material sent in.

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NEWS - ARCHAEOLOGY

Dating confirmation for human remains from Kent's Cavern, Devon

A human jawbone including three teeth discovered in Kent's Cavern, near Torquay, in 1927 was dated at about 31,000 years old. However, there have been doubts about this, as the radio-carbon dating process may have yielded a spurious date as a result of glue used to repair the specimen. Fortunately other material from the same excavation, associated with the jawbone, have also been preserved, and further specimens have been dated, yielding ages of between 37,000 and 40,000 years, suggesting the jawbone was of an early Neanderthal man, or one of the very earliest modern men.

The caves at Kent's Cavern, on the south Devon coast, and associated exhibition galleries are open to the public (along with the inevitable shop and a café) - the website is www.kents-cavern.co.uk .

Source: Colin SCHOFIELD, 2005, Human jawbone find at Kent's Cavern. *Down to Earth* 51, page 7.

An ice well at Gravesend, Kent

In April 2001 a hole appeared beside the road at Horn Yard, Gravesend, revealing a deep circular brick structure 3.5m in diameter, the domed top of which had collapsed. This was investigated by members of the Kent Underground Research Group (KURG) who have, on the basis of archaeological examination and documentary research, identified the feature as an ice well made between 1850 and 1855, probably for use by a fishmonger. The well, at least six metres deep below the ground surface, has associated access tunnels and steps on the west side. Having been surveyed and recorded, the void has now been infilled and the road made safe.

Source: Rodney F. LE GEAR, 2005, An ice well at Gravesend. *Kent Archaeological Review* 161, 6 - 9.

Another scroll from the desert in Israel

Two fragments of parchment almost 2,000 years old have been found in the possession of a 'Bedouin robber' in a desert valley near the Dead Sea in Israel. None have been found in the Judean desert since 1965, although it is now suggested that if scholars 'bother to excavate, survey, and climb' amongst the rocks in the area, more may well come to light. The two scraps bear verses from Leviticus written in Hebrew, and are thought to have come from the 'refugee caves' in a canyon named Nachal Arugot, where Jews hid from the Romans in the second century.

Source: ANON, 2005, Biblical scroll found in desert. *The Guardian*, 16 July 2005, page 16.

NEWS - CONSERVATION HERITAGE AND TOURISM

Blaenavon Big Pit in line for prize

The Big Pit coal-mining museum at Blaenavon, South Wales, is amongst four industrial museums shortlisted for the £ 100,000 Gulbenkian Prize. Big Pit is said to be 'the only genuine coal mine deep shaft [in Britain] open to visitors, who are guided by former miners.' The other place in Britain, of course, where members of the public can descend a genuine, if not so deep, colliery shaft and enjoy a conducted tour around former colliery galleries is at the Caphouse colliery, outside Wakefield.

Source: Maev KENNEDY, 2005, Industrial museums in line for prize. *The Guardian*, 22 March 2005, page 8.

Hosey Common quarry tunnels at Westerham (Kent) accorded RIGS status

The several series of underground quarry tunnels at Hosey Common, south-east of Westerham, have now been accorded RIGS (Regionally Important Geological Site) status as a result of a submission by Subterranea Britannica Chairman Paul Sowan. This is a designation officially recognised by English Nature and by planning authorities, and adds to the protection these tunnels already enjoy as an important bat hibernation site.

The geological grounds on which the designation was awarded were (1) the very clear exposures (underground) of the alternating 'rag' and 'hassock' beds of the Hythe Beds (Lower Greensand); (2) the Kentish rag at this location being representative of the sandstone facies of this formation, in contrast with the more usual limestone found in the Maidstone area; (3) the possible palaeontological research potential of the earth-filled gulls clearly visible and accessible from underground; and (4) the cultural interest of these readily accessible rural subterranean quarry workings.

Source: Kent RIGS Group

Centre Historique Minier, Lewarde, France

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This coal-mining museum, close to Douai in northern France, presents three centuries of coal-mining history in the Nord / Pas de Calais region. This is a genuine colliery site, with well-preserved authentic buildings containing a wealth of well-displayed colliery-related material, from plant to social history, and certainly well worth a visit for anybody half interested in this important former industry.

There is a simulated underground tour, through mine galleries re-created inside surface buildings. When I last visited, this commenced with a surface ride on a little yellow train, followed by an ascent to the second or third storey of a pithead winding and screens building. There followed a slow descent in a mine cage, where you are accompanied by a guide describing the deep shaft you are not in fact descending. At 'pit bottom' you find a little yellow train (the very same, but masquerading as a second such, deep underground) and traverse by train and on foot a series of quite realistically re-created mine tunnels. Sun shining under the emergency escape door finally gives the game away to anyone fooled thus far! More up-to-date details on the website www.chm.lewarde.com

Les dessous (boves) d'Arras, France

A small part of the extensive network of 'boves' or chalk tunnels below Arras, linked together by the British and Empire troops in World War I, is open to the public. Access is gained from the tourist office in the ground floor of the Hôtel de Ville, Place des Héros, Arras, with guided tours taking 35 to 50 minutes. It is possible to learn of the original purpose of the excavations (quarries for building stone, cellars, and perhaps also hiding places) and some aspects of the World War I use by the military. When the German front line was very close to the city, the making of connecting tunnels joining up previously isolated 'caves' made it possible for men to reach the front under cover most of the way. Local publicity in May 2005 reported the additional attraction in the caves of exotic plants! There is also the possibility of taking a lift to the top of the town hall tower for a bird's eye view of the city and district.

NEWS - MILITARY

An Iraqi bunker discovered

A network of underground bunkers has been discovered in Iraq. The largest complex, measuring 166 by 269 metres, is located at an old quarry near Karma, in Anbar Province, west of Baghdad. The bunker is described as an 'insurgents' hideaway" equipped with kitchens and air conditioning, and stocked with food supplies. No 'Weapons of Mass Destruction' are reported, although there were uniforms, night vision goggles, masks, compasses, satellite telephones, machine guns, mortars, and rockets.

Source: Rory CARROLL, 2005, US troops uncover bunker network in Iraq. *The Guardian*, 6 June 2005, page 14.

HO8 German Tunnels re-opened on Jersey

What have been known as the Underground Hospital tunnels on Jersey (in fact used by the occupying German forces in World War II primarily for offices and storage, with a treatment centre added near the end of the war and never actually used as such) were re-opened to the public at 07.14 on the morning of 9 May 2005 in connection with the local celebration of VE Day (one day later than the rest of Britain.) News of the German surrender was broken in Jersey on 9 May 1945. The half-mile tunnels system, Höhlgangsanlager 8 (shelter cave 8) was one of 16 such systems on the island, and lies below the Medowbank valley. They had, in the event, no shelter function, as the occupied island was never bombarded by Allied forces.

The tunnels were excavated in hard shale by blasting and manual mucking-out, then lined with brick or concrete.

Prominent in the re-vamped displays are Winston Churchill's words *'Let 'em starve. No fighting. They can rot at their leisure'* inscribed on a slab or rock. These words, presumably referring to the occupying forces, were scribbled by the wartime leader at the foot of the minutes of a Cabinet meeting on 27 September 1944, when the occupied Channel Islands were discussed.

Information on the new museum may be found at www.jerseywartunnels.com .

Source: Maev KENNEDY, 2005, Light shines on Jersey's wartime tunnels. *The Guardian*, 4 May 2005, page 15.

Suspected North Korean nuclear test site

What appears to be evidence for tunnelling at a remote mountain site in north-eastern North Korea, detected from satellite photography, is the subject of conjecture in the west. One interpretation is that the North Koreans are making preparations for underground

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nuclear weapons testing, it being estimated that the country now has sufficient weapons-grade fissile material for up to six bombs. An alternative view is that this is a North Korean bluff calculated to exert diplomatic pressure.

Source: Julian BORGER and Jonathan WATTS, 2005, Spy photos spot signs of N Korea nuclear test site. *The Guardian*, 7 May 2005, page 13.

NEWS - HEALTH AND SAFETY

The 2004 British Cave Rescue Council Report

The British Cave Rescue Council's report on cave rescues in 2004 has been published in the caving magazine *Descent*. This summarises statistics and reports on the 30 occasions when Cave Rescue Organisations have been called out during the year. This includes eight occasions when CROs were called out to assist police or ambulance personnel for what were usually surface searches in areas that happened to have cave or mine entrances in the neighbourhood. The sites were all either natural caves (23) or mines (seven.) Twenty-two were 'underground' incidents, and seven on the surface. Call-outs featured a wide range of scenarios, including searching for missing children who were found on the surface, missing people lost in fog on the surface, and animals rescued from caves or mines into which they had fallen. One callout proved to have been a hoax, another was to check dumped drums of reportedly corrosive chemical which proved to be empty, and a third was to help to investigate the scene of what appears to have been a suicide on the surface.

Incidents underground included a man with a suspected broken leg, stretchered out of a show-cave, a boy stuck in a tight squeeze (coaxed out with encouraging words which gave him the confidence to wriggle free!), various persons exhausted or lost underground, a few falls and broken bones, and one fatal fall (the only underground fatality) of 18m underground in a pothole. The total number of persons injured underground was nine.

Summary statistics for 1996 - 2004 are also presented, indicating falls and persons lost or overdue as the main causes of incidents, and exhaustion and hypothermia as the most frequent ill-effects.

Source: ANON, 2005, The Rescues of 2004. *Descent* 184, page 5.

How safe are our city basements?

The ground below the world's largest cities is being turned into a 'Swiss cheese' of tunnels, and underground shops, and car parks. Janos Bogardi, of the Institute for Environment and Human Security at the United Nations University in Bonn has questioned the extent to which the cities' subterranean infrastructure and its inhabitants are vulnerable to fire and flooding. Should flood prevention doors be installed, such as are found on the London Underground system? And fire doors? Attention is called to a lack of overall maps shewing the distribution and levels of all the interconnected spaces below the world's great cities (and indeed the locations and levels of major water mains and sewers.) Some members of Subterranea Britannica will recall the late Ellis Hillman's plea for an overall map of underground London, some decades ago! No such map seems to exist, even now.

Source: Ian SAMPLE, 2005, Big cities face threat from below. *The Guardian*, 14 January 2005, page 10.

The Äspö Hard Rock Laboratory, Sweden

The Äspö Hard Rock Laboratory at Oskarshamn, about 360 kilometres south of Stockholm, is a network of over 3,600 metres of tunnels in diorite rock at an average depth of around 460 metres. The geological context resembles the conditions likely to be selected in the event of Sweden excavating an underground nuclear waste depository. The Swedish waste management company SKB has commissioned the British Geological Survey to undertake some trialling, with non-radioactive materials, of techniques for preventing the leakage of radionuclides from stored waste.

The Swedish nuclear waste disposal concept envisages canisters of waste weighing up to 27 tonnes each, placed in large-diameter boreholes drilled into the floor of the underground repository tunnels. Each canister will be of 50mm thick copper, with a surrounding packing of bentonite clay. The BGS research will deal with the geochemical and physical behaviour of the clay in the event of corrosion of the canisters, and chemical reactions releasing gas (hydrogen) and allowing the leakage of radioactive materials into the groundwater. In the Hard Rock Laboratory tests, a deposition hole 1.8 meters in diameter and 8.5 metres deep will be used, with non-radioactive and non-hazardous materials (helium instead of hydrogen for example) used to simulate the effects of canister corrosion, and test the reliability of the system in containing reaction products.

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Source: Jon HARRINGTON, David BIRCHALL, and Steve HORSEMAN, 2004, LASGIT: large-scale gas injection test at the Äspö hard rock laboratory, Sweden. *Earthwise* 21, 26 - 27.

NEWS - MINING AND QUARRYING

The Seven Sisters limestone mine at Wren's Nest, Dudley, West Midlands

The large limestone mine at the Wren's Nest Hill at Dudley worked in the Silurian Wenlock Limestone, the beds here dipping at 45°, was where your Chairman, Paul Sowan, was first introduced to underground archaeology in the 1960s. The mine was a steeply inclined pillar-and-stall working, communicating with the Dudley canal tunnel below it, and ceased work around 1875. After a major roof fall in 2001, all but the uppermost daylit part of the underground workings have been filled for stabilisation purposes, leaving visible only the uppermost row of 'seven sisters', large roof-support pillars of unworked stone. After further falls of roof in this uppermost surviving part of the mine, the remainder has now been stabilised by total filling with 30,000 tonnes of loose, dry stone aggregate. It is suggested that 'when funds become available for further remedial works' this loose fill can be removed and the roof secured by rock-bolting, to make visible again this impressive sample of underground mining landscape. Tony Waltham's photograph of the Seven Sisters before the final filling operation accompanies his report.

Source: A.C. WALTHAM, 2005, Dudley limestone mines. *Geology Today* 21(4), back cover.

Dealing with the legacy of salt mining at Northwich, Cheshire

Rock-salt mining at Northwich commenced in 1670, and ended with the closure of the last of the four mines in 1920. The town was notorious for mining subsidence, and a prolific source of dramatic photographs of leaning, distorted, and collapsed buildings. The mine-shafts allowed fresh-water to get into the old workings, the rocksalt support pillars dissolved, and the mines fell in. After the mines closed, they were filled with saturated brine to prevent further dissolution by ground-water, although of course ground-water movements and the arrival of further freshwater to weaken the brine led to a continuing if less urgent problem. The flooded mines are now to be stabilised by pumping in about 1M tonnes of a grout / salt / brine mixture. The existing brine in the collapsed mine cavities will have to be pumped out at the same rate as the grout is pumped in. Brine not required in the grout mix will be tankered to British Salt's works 15km away at Middlewich, as feedstock for its salt production. The affected area of about 30 hectares has been intensively probed to establish the extent of the brine-filled voids, some 500 vertical and inclined investigation boreholes having been put down.

Visitors to Northwich today will see few seriously distorted buildings, but there is a highly recommended museum on the outskirts of the town devoted to Cheshire's important salt industry. The only exclusively rock-salt mine still at work in England, at Winsford, is quite dry underground, as care has been taken to prevent water access! Some rock-salt is also mined, alongside the more important potash (carnallite, or potassium chloride) at Boulby mine on the Cleveland coast. And rock-salt is also mined at Kilroot, in Northern Ireland. The Winsford rock-salt is used, unpurified, for de-icing roads. The Middlewich salt works' normal feedstock is brine pumped using a carefully controlled solution-mining technique, which creates isolated brine-filled cavities designed to be of certain shapes and sizes within the rock-salt beds well within the mechanical strength of the host material.

Source: Adrian GREEMAN, 2005, Grouting ends salt mines threat to town centre. *New Civil Engineer*, 27 January 2005, page 12; with additional material from Paul W. Sowan.

A newly discovered mine in the Mendip Hills, Somerset

Prospecting work on western Mendip by David Upperton of Wessex Caving Club has revealed a hitherto unknown mine (given the appellation King Mine) on the flank of Sandford Hill. A 7.5m shaft communicates with a 120m network of passages, including at one point a natural cavern six metres high, seven metres wide, and 15 metres long. The mine appears to have been intended to exploit iron and / or zinc ores, as traces of haematite (iron oxide) and calamine (zinc carbonate) are present. An underground spoil heap is being examined in the hope of discovering mining or datable artefacts.

Source: ANON, 2005, King under Sandford Hill. *Descent* 184, page 11.

Work at Taffs Well Quarry, near Cardiff, may affect the ancient Garth iron mines

Taffs Well Quarry, near Cardiff, is worked by RMC, who propose to deepen their opencast pit and improve their access to it by driving a tunnel for their lorries to replace the existing surface roadway. This tunnel is

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proposed to pass below the Lesser Garth Cave, and near the Garth iron mines. Discussions are in train to try to ensure that both underground features are safeguarded from the work, from quarry blasting, and from the vibration caused by up to five lorries every three minutes at peak times.

Source: ANON, 2005, Taffs Well Quarry. *Descent* 184, page 15.

Access to Mineral Heritage - or is it Mining Heritage?

Subterranea Britannica has received papers and a questionnaire requesting information on mineral or mining records headed, variously, Access to Mineral Heritage (on the letterheading) or Access to Mining Heritage (on the accompanying flyer), the enquiry being described as 'A project of the Coal Authority.)

To what extent those behind this project view the mineral or mining heritage of the UK as a cultural asset of archaeological and historical importance, or as a statutory nuisance, is not entirely clear. Why is there this sudden drive, in financially straitened times in the coal industry, for mining records. Is it to save money on desk studies of 'brownfield' sites earmarked for development?

The more or less explanatory flyer proposes the setting up of a web portal for information about sources (or information about minerals, or of the minerals themselves?), for 'access across the heritage sector', and for 'minerals across the UK.' Under the heading 'Who is behind it' it is stated that the Coal Authority, a Government body, seeks to make information about coal and other mineral industries available to the 'widest possible audience.' Of course, the British Geological Survey has been doing that since 1835! And it is only 10 or 15 years since Arup Geotechnics compiled a massive report on mines and potential mining instability in Britain, commissioned by the Department of the Environment. The hope is expressed that the data collected will be 'useful to researchers, educational users, and the public at large.'

We have replied that we maintain no library, nor any archive other than of our own domestic records and publications. Printed and published material received is generally deposited in some appropriate established and publicly accessible library. However, your Chairman does maintain an information service on economic geology, the most accessible part of which is the bibliography of mining and quarrying sources (mostly but not exclusively published) for the entire British Isles. This is available via our Website. Contact details for the Project are: Access to Mining (or Mineral) Heritage, 200 Lichfield Lane, MANSFIELD, Nottinghamshire NG18 4RG (telephone 01623-638234 / Email accessproject@coal.gov.uk . There is also a website, http:// www.mininghistory.org.uk/ .

Sources: papers and questionnaire received

Parys Mountain copper mines (Anglesey) drained

A considerable head of acidic water containing large quantities of dissolved iron and copper salts was, until recently, impounded within the Parys Mountain copper mines on Anglesey, held back by an underground concrete dam of unknown but undoubtedly deteriorating soundness. With the consent of the Environment Agency, this dam has now been breached, and the water released, untreated, via a watercourse into the sea. What effect this has had on marine life in the area has yet to be reported! The most visible effect of this action is the disappearance of the 'lake' that used to exist in the bottom of the huge opencast mine pit. As this lake had been a favourite dumping place for old cars and similar junk, it was expected that these would come to light on the lake being drained. However, it seems that most of the dumped metalwork has disappeared, in solution, in the acidic water. It is now, of course, possible to descend to lower levels then previously inside the mines themselves. But a number of the deep red-brown acidic pools remain *in situ* underground as one of the characteristic features of underground visits here, which will be remembered by Subterranea Britannica members who visited the mines a few years ago.

Source: Richard Shaw

Recommencement of mining at Parys Mountain, Anglesey

Parys Mountain (147m) is actually a hill about 2.5km south of Amlwch, on the north coast of Anglesey. At its summit is a huge man-made crater, the result of opencast mining principally for copper in the 18th / 19th centuries. Parts of the hill not excavated away are riddled with abandoned mine shafts and tunnels, including some from as far back as the Bronze Age. About 19 km of mine galleries are thought to have been dug. Members of Subterranea Britannica who visited and went underground during the North Wales Study Weekend a few years ago will remember the deep pools of dark red-brown acidic water, the similarly acidic mud, the low tunnels, and the very colourful

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copper ores still to be seen. This was once one of the world's most important copper mines in its day.

Recent changes in the prices of metals on world markets have made it worthwhile considering recommencing mining, with copper, zinc, lead, and even some gold as the products. Reserves or ore are thought to be sufficient to allow an output of up to 350,000 tonnes of ore per annum for six or seven years. This is seen as good new in Amlwch, where a chemical factory (the major employer) closed recently.

Source: Steven MORRIS, 2005, Ore miners return to Welsh mountain 100 years after the digging stopped. *The Guardian*, 13 June 2005, page 11.

The birth and death of the Selby Coalfield

When Mike Gill worked for the former National Coal Board during the years 1969 - 74, proposals for mining coal below Selby were seen by some as somewhat fanciful, in the light of colliery closures and the advent of North Sea oil and gas. The eventual development of the Selby scheme in the late 1970s and early 1980s was the largest deep mine development ever undertaken in the UK, encompassing an area of 110 square miles, with 10 shafts and two drifts serving the five mines (Riccall, Wistow, Stillingfleet, North Selby and Whitemoor) all connected to a main haulage route of two parallel 15-km tunnels exiting at the two drifts at Gascoigne Wood, where all coal was brought to surface. Thence, rail transport took it to electricity generating stations. The development, and eventual decline and closure of this vast underground complex is described in some detail in Mike's recently published article. The last of the five mines, Riccall, last cut coal on 26 October 2004.

Source: Michael C. GILL, 2004, Death of the Selby Coalfield. *Newsl. Northern Mine Research Society*, December 2004, 6 - 8.

National GIS-linked database of UK mines and quarries / Geoscience Data Index

The British Geological Survey has collected data on active and defunct mines
and quarries since it was founded, as the Geological Survey of Great Britain, in 1835, and from time to time has published printed lists of active mineral workings. The Survey is now creating an electronic database called BritPits to make all this information more readily accessible, commencing with currently active mines and opencast workings, but in due course extending back in time to include inactive and abandoned workings. A digital index to the locations of all currently active mines and quarries can be viewed on the BGS website in the Geoscience Data Index (www.bgs.ac.uk/geoindex) under the geology section.

Source: Don CAMERON, 2003, BritPits: a national GIS-linked database of UK mines and quarries. *Earthwise* 19, page 27.

Hatfield colliery to reopen?

Newspaper reports suggest that Richard Budge, former head of RJB Mining, is negotiating with a view to reopening the Hatfield Colliery near Doncaster, in the South Yorkshire Coalfield. His company Coalpower is rumoured also to be considering building a new coal-fired power station at the mine. And the global warming threat posed by yet more carbon dioxide gas added to the atmosphere can, it is reported, be met by disposing of this in place of the oil pumped from producing oilfields. Budge owned most of the UK's post-denationalisation deep coal mines before selling the business to UK Coal. The Hatfield Colliery opened in 1910, and in its time produced over a million tons of coal a year.

Source: ANON, 2005, Richard Budge 'poised to reopen Hatfield Colliery.' *Down to Earth* 50, page 4.

Another historical mining accident record from the Reading chalk mines in 1794

The *Reading Mercury*, in its issue dated 10 November 1794, reported that one Richard Dewell, brickmaker, was 'accidentally killed at Mr. Sharman's brick kilns in this town; he had been working in a chalk-well, and was coming up to take his dinner, but when he had nearly reached the top, the spindle of the wheel broke, and he fell to the bottom, nearly sixty feet, by which his neck was broken, and he was otherwise much bruised.

Source: *Reading Mercury*, 10 November 1794.

Scope of Reading chalk mines survey reduced

Planned ground investigations at the Field Road and Castle Hill area in western Reading, in search of possible extensions of the known area of chalk mining at Field Road, are to be scaled back as an economy measure. Originally micro-gravity underground radar was to have been used to detect any further cavities. The less expensive electrical resistivity surveying method is now to be used, in a reduced area, excluding Petworth Court, Glenby Terrace, the west side of Jesse Terrace, and the east side of Carey Street. Peter Brett Associates will concentrate on the

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immediate area of Field Road and Deepdene Close. Other areas of Reading where there have been recent collapses into known or suspected chalk mines are also under consideration.
Source: Karl PLUNKETT, 2005, Chalk mine danger area survey reduced due to lack of cash. Cheaper method to be used and homes will be missed. *Reading Chronicle*, 3 March 2005, page 4; ANON, 2005, Horrors beneath streets will at last be identified. *Reading Chronicle*, 21 April 2005.

Yet another Reading chalk mine discovered

Investigations in the Coley district of western Reading, where houses were wrecked by subsidence in Field Road five years ago, have brought to light another chalk mine in the town, this one having galleries five metres high, 11 metres below the back garden of Clevedon Lodge, a five-storey building at Castle Hill.

Source: Linda FORT, 2005, Chalk mine find in back garden. Five years on from Field Road. *Reading Evening Post*, 18 July 2005, pages 1 and 3.

British coal-mining records

With the winding up of the former National Coal Board, and of its successor the British Coal Authority, and their replacement by the Coal Authority (established by the Coal Industry Act) there may be some confusion as to where surviving mine records are now kept. The Coal Authority's Mining Records Office at Bretby closed in September 1991, the mines abandonment plans then being transferred to the CA Mansfield headquarters. The prime geological records are now accommodated by the British Geological Survey (BGS) at Keyworth, near Nottingham, where 6,304 archive boxes (occupying over a kilometre of shelving) from Bretby are held. A further 2,712 boxes of related records have been added to them. Further details can be found in an article in the BGS magazine *Earthwise*, and on that organisation's Geoscience Data Index on its website at www.bgs.ac.uk/geoindex/ .

Source: Rod BOWIE, 2003, British coal mining: the Prime Geological Record. *Earthwise* 19, 6 - 7.

Merstham underground quarries closed

The two mines [underground quarries] known as Quarry Dean (also known as No. 2) and Football Field Mine (No. 4) at Merstham in Surrey are no longer accessible. Since March, the landowners have said that anyone visiting the sites will be regarded as a trespasser.

The Wealden Cave & Mine Society had had a good relationship with the family that owns this site for many years. One of the co-owners, who recently inherited the property, is now in dispute with Wealden over the society's past activities. Members of the Society hope that the dispute will be resolved satisfactorily, but until further notice access to either mine is not permitted.

Source: Peter BURGESS, 2005, Merstham mines. *Descent* 184, page 33.

An inventory and documentation of Dutch underground building limestone quarries

Our member and Dutch correspondent, Joep Orbons of Maastricht, has compiled an inventory of underground limestone quarries in Zuid Limburg, in the Netherlands. The document lists 287 quarries by names (alternative names are also supplied), and locations, with 556 entrances and covering an area of 368 hectares. The numbers of quarries by districts are Gulpen-Wittem (1), Heerlen (3), Maastricht (100), Margraten (147), Meerssen (17), Simpelveld (1), Vaals (6), Valkenburg a/d Geul (275), and Voerendal (6.) Location maps and plans are supplied.

Source; Joep ORBONS, 2005, *Inventarisatie van de ingangen van onderaardse kalksteen groeven in Nederland 2002 - 2004*. Maastricht: Studiegroup Onderaardse Kalksteengroeven: 106pp + 2 CDs.

Giant selenite crystals in Naica lead - silver mine, Mexico

The discovery, during mining operations, of a large natural cavity containing crystals of selenite (a form of gypsum, or calcium sulphate, $CaSO_4.2H_2O$) has been reported. The crystals, up to 50 feet long, were found at the Naica lead-silver mine in central Chihuahua, Mexico.

Source: John ROSS, 2003, Bedazzled! A thousand feet underground, two miners stumble upon Nature's crystal palace. *Reader's Digest*, May 2003, 110 - 112

Earthquake at Stilfontain, South Africa, traps gold miners

Major earthquakes are uncommon in South Africa, although there are numerous small ones often triggered by the collapse of old subterranean mine workings. The last large one, magnitude 6.3, was to the north of Cape Town in 1969. Now another large earthquake, magnitude 5, has occurred at Stilfontain,

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about 97 miles south-west of Johannesburg. This resulted in rock falls about 1.5 miles underground in a gold mine, trapping miners. Preliminary shocks had led to about three-quarters of the mine's 3,200 mining workforce being evacuated before the major shock caused serious damage. Of 40 men trapped by fallen rock, 39 were rescued alive, and one body recovered. As many as 300 other miners had to remain underground for some time while safety checks were carried out on evacuation routes. The miners had with them their own life support systems with air and water.

Source: Alistair THOMSON, 2005, 39 saved underground after quake strikes South African gold mine. *The Guardian*, 10 March 2005, page 13.

American mining ghost town to be anti-terrorist training centre

The mining company town Playas, New Mexico, was built by the Phelps Dodge company in the 1970s, but is now a ghost town following the closing down of the copper smelter in 1999. The population has declined from 1,000 to 58, most of whom are employed looking after the mothballed smelter. This trend is about to be reversed, as the Department of Homeland Security is to fund the development of America's premier anti-terrorist training centre, to be operated by a small engineering firm, New Mexico Tech, which has bought the town. Each month, the company will run simulated terror scenarios, creating up to 200 jobs.

Source: Tim REID, 2004, Ghost town overjoyed by anthrax. *The Times*, 2 October 2004, page 20.

Chinese colliery blast

There was an explosion of ignited methane at the Shenlong coal mine, in the western region of Xinjiang, China, on 11 July 2005. At least 87 miners were working underground at the time of the blast (02.30 a.m.), of whom at least 59 are known to have died. Twenty-four were reported missing, and four escaped.

In 2004 more than 6,000 coal-miners were killed by accidents and explosions in Chinese mines.

Source: ANON, 2005, Mine blast kills 59 in China. *The Guardian*, 12 July 2005, page 14.

19 killed in illegal coal mine in Shanxi Province, China

A gas explosion at an 'illegal coal mine' in Shanxi Province killed 19 people in 'the world's deadliest mining industry.'

Source: ANON, 2005, 19 killed in Chinese mine. *The Guardian*, 4 July 2005, page 17.

NEWS - MISCELLANEOUS

Carshalton Park Grotto open to the public

Carshalton Park Grotto, built for Thomas Scawen in about 1724, was intended to be viewed from the south front of a large mansion that was never completed. The main octagonal room, described in 1895 as having a domed roof and 'walls fantastically covered with flints, scraps of ironstone, shells, and the like' had a tessellated flood of black and white marble. After 1913 the site was in public ownership and the interior 'unsympathetically restored.' Only a few fragments of the restored decoration survive. A pool at the front of the structure is fed by culverts in the chalk sixty feet below.

Source: LB SUTTON, 2005, Rare garden feature opened to the public. *London Archaeologist* 11(1), page 28.

Cave house for sale at Knaresborough, North Yorkshire

For something in the region of £ 450,000 you could purchase your own four-room underground house, half-way up a 60m high limestone cliff at Knaresborough. This was excavated in 1770 by one Thomas Hill, a linen-weaver, with access to and from the cliff-top by way of a series of spiral staircases. The front wall has now been stabilised, the interior fully restored, and the former tourist attraction, known as *The House in the Rock*, is offered for sale by Carter Jonas, from whom further particulars can be obtained.

Source: ANON, 2005, Another cave house for sale. *Descent* 184, page 5.

Possible ornamental Tudor garden underground grotto discovered at Beddington (London Borough of Sutton)

Excavations at Carew Manor, Beddington, have revealed a site tentatively interpreted as a small (about two metres long) ornamental garden underground grotto of about 1570. Materials discovered thought to be parts of the internal decoration of the structure include 'small sheet copper leaves and fish', pieces of

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coral, tropical sea-shells, and 'the sparkling rocks, granite and mica.'

Source: ANON, 2005, England's oldest grotto? *Follies* 16(2)(61), page 6 [Beddington: Carew Manor: excavated remains interpreted as an ornamental garden grotto of c. 1570]

George Bush hides from a cloud

The President of the USA was 'bundled into an underground bunker' at an 'undisclosed location' when a fast-moving object, which turned out to be a cloud, was observed approaching the White House in Washington on 28 April 2005. Heavily armed secret servicemen and an anti-aircraft missile battery were deployed in defensive positions, but had nothing substantial to shoot at.

Other false alarms since 11 September 2001, forcing the President underground, have been caused by flocks of birds, and private aircraft 'wandering off-course.' There is a Presidential Emergency Operations Centre below the White House.

Source: Julian BORGER, 2005, Incoming cloud forces Bush into safe bunker. *The Guardian*, 29 April 2005, page 1.

New use for a Cold War bunker at Twyford, Hampshire

Symantec, described as 'the world's largest internet security vendor,' has its European Security Operations Centre in an underground bunker in a field close to Twyford, Hampshire, according to an article by Ken Young in *The Guardian*'s *Life* supplement, which includes a photograph of the front entrance. The bunker, 'designed to house 30 people for 60 days', was built 'between 1988 and 2000' but decommissioned only a few years later. The work of Symantec is described.

Source: Ken YOUNG, 2005, Under control: the fight against malicious internet hackers and viruses is being organised from a former nuclear shelter. *The Guardian Life*, 3 March 2005, page 20.

Derelict land, brownfield sites, or archaeological resource and heritage?

Twelve 'derelict areas of England' have been earmarked for a 'multimillion pound makeover.' This, it has been reported, 'will breathe new life into 66,000 hectares (164,000 acres) of old industrial land.' English Partnerships has surveyed 'underused' land which could be used for new business and housing, potentially saving greenfield areas from development.

Source: Peter HETHERINGTON, 2005, Twelve sites chosen for makeover. *The Guardian*, 22 February 2005, page 17.

Tunnels of love for Norfolk newts!

Great Crested Newts, removed from the route of a bypass at Wymondham to a new pond, were provided with tunnels under the road to allow them to reach meadows safely to meet mating partners. Up to 3,000 frogs and toads are also expected to use the tunnels.

Source: ANON, 1991, Tunnels of love to break impasse over 20 rare newts and £ 18m bypass. *The Guardian*, 21 August 1991.

Nuclear waste burial urged

Fifty years after commencing the production of nuclear waste, Britain has still not decided on a permanent storage system for this dangerous material. It is still kept in 'temporary' surface tanks, which in the modern political climate are perceived to be seriously at risk from terrorist attacks. A House of Lords Committee has urged the construction of deep underground caverns for the permanent storage of surplus radioactive waste, well out of harm's way, taking the view that leakage caused, for example, by earthquakes and geological faulting is far less likely than deliberate or accidental damage to surface storage facilities.

Source Terry McALISTER, 2004, Bury nuclear waste, says report. *The Guardian*, 10 December 2004, page 7.

Nuclear waste disposal in the UK

A hitherto 'secret' list of 537 UK sites deemed to be suitable for the storage of up to 250,000 cubic metres of nuclear waste, to remain effective for 100,000 years, has been published following an enquiry under recent freedom of information legislation.

The list was drawn up in the 1980s by 'a team of Government geologists' and others, and includes national parks, existing nuclear power stations, military bases, off-shore sites, and remote Scottish islands. Sixteen sites in the Shetland Islands, 21 in the Western Isles, and 45 in the Scottish Highlands are included. Gruinard Island and Porton Down are both listed. A proposed underground repository at Sellafield was rejected by the then Environment Secretary, John

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Gummer, in 1997. The waste is at present stored ar 34 surface locations. A NIREX spokesman has reportedly said that at this stage no listed site has been ruled out.

Source: John VIDAL, 2005, Secret list of possible N-waste sites revealed. *The Guardian*, 11 June 2005, page 4.

London Underground Limited aerial photography for site inspection

Large parts of the London Underground system are surface lines, or short stretches open to the sky between cut-and-cover tunnel sections. Much of the infrastructure is relatively inaccessible, making site inspections problematic, especially as generally the daylight hours are preferred for visibility. Access on foot while trains are running calls for the presence of engineers, lookout men, and the like. London Underground Limited is now using periodic aerial photography to keep a check on the state of their property, boundaries, and the activities of their neighbours (some of whom seem tempted to encroach or to dump rubbish on railway land which is of course even more troublesome and expensive to remove and dispose of.) Next time your tube train emerges briefly into a sunlit stretch between tunnels, remember, somebody may be watching from the sky!

Source: ANON, 2005, LUL saving time and reducing risk through the use of aerial views. *Railondon* 89, page 6.

Soviet mapping of Britain

More or less Great Powers generally accumulate masses of detailed information about their allies, enemies, and other countries.

Obviously this includes available maps. In some instances, some such Great Powers (of which the UK was once one) produce their own maps of foreign countries. We the British, for example, printed quantities of large-scale topographical and geological maps of parts of Belgium and France for use by our forces during World War I. And Germany printed a series of colour-printed maps of much if not all of the UK during World War II, for the use of the invasion that never happened. So it is no surprise to find that the USSR compiled detailed maps of our country during the Cold War, with place-names rendered into Cyrillic lettering, which would certainly have assisted Russian speakers in getting the pronunciation right. Sets of these Russian maps are now becoming available. John Davies has published the first part of a guide to them in the journal, *Sheetlines*, of the Charles Close Society, an organisation devoted to the study of Ordnance Survey (and other) maps. This includes some reproductions, including some in colour.

Source: John DAVIES, 2005, Uncle Joe knew where you lived. The story of Soviet mapping in Britain (Part 1.) *Sheetlines* 72, 26 - 38.

Hotel Moskva mined!

Hotel Moskva, Moscow's once leading hotel, is currently being demolished for re-development. A surprise discovery of almost 1 tonne of explosives built into the basement is thought to have been placed during World War II to effect demolition in the event of the Nazis seizing the Russian capital.

Source: Nick Paton WALSH, 2005, How Stalin's favourite hotel hid a tonne of explosives. *The Guardian*, 16 July 2005, page 15.

German and British inter-war mapping compared

A recent article in the journal of the Charles Close Society (for the study of Ordnance Survey maps) is the first part of a study comparing British and German mapping between the wars.

Source: J.L. CRUICKSHANK, 2005, The Reichsamt für Landesaufbahme and the Ordnance Survey: a comparison of two mapping organisations between 1919 and the Second World War (Part 1.) *Sheetlines* 72, 9 - 22.

White witch wedding in Edinburgh underground temple

A legal pagan 'witch wedding' of a Canadian couple has been celebrated in the Niddry Street Temple of the Source Coven of the Blue Dragon, in Edinburgh's Old Town. Bride and groom, their hands tied together, jumped over a broomstick as the High Priestess swept the circle in which the ceremony was performed to get rid of evil spirits.

Source Stephen BATES, 2004, White witch wedding: couple tie the knot - literally - in underground temple. *The Guardian*, 23 September 2004, page 8.

First unabridged English translation of *The Underground City*

The first unabridged English translation of a work of fiction by Jules Verne [1828 - 1905] which first

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appeared in Paris in 1877, has been published, featuring a 'Coal City' in an abandoned coal-mine 1,500 feet below Loch Katrine in the Trossachs.

Source: Paul KELBIE, 2005, Underground Scots, *Geology Today* 21(3), 83 - 84 [From *The Independent*, 30 March 2005]

Car storage silo at Wolfsburg, Germany

Grain silos and nuclear missile silos we have all heard of. But at Volkswagen Europe's plant at Wolfsburg, there is a silo for storing cars! A photograph accompanying a recent newspaper article shews a circular pit with at least 12 tiers of storage places for cars, each of which can evidently hold at least 19 cars. A central column is equipped with a pair of lifting devices used to lower cars into the pit for storage, or retrieve them, as required. So far as can be seen in the photograph, there is no regular human access.

Source: David GOW, 2005, VW puts brave face on diminishing returns. *The Guardian*, 9 March 2005, page 18.

Krubera cave (Georgia) bottomed by Ukrainian cavers

The German magazine *Der Spiegel* has reported that a group of Ukrainian cavers has set a new caving depth record by descending a vertical distance of 1.3 miles in the Krubera cave below the Arabika massif in Georgia. From a cave entrance 2,250m above sea level they reached a point only 170m above sea level. The descent took 17 days, the cavers set up four underground camps, and took three kilometres of rope with them to assist their descent, not to mention their climb out again!

Source: ANON, 2005, Cavers hit an all-time low. *The Guardian*, 7 May 2005, page 24.

The Science Museum Library

The superb Science Museum Library some years ago moved into, and is now accommodated within, the Library of Imperial College in South Kensington. It has been reported that the Museum is considering disposing of 95 percent of its collection of half a million books, journals, and documents, because 10 years of falling government grants mean it can no longer afford to keep them. The Library was established in 1883 and until the 1960s was Britain's national library of science, technology, and medicine. It is now in jeopardy because Imperial College has increased by 400% its service fees. Unless the Government, or some other source of funds, makes good the £ 200,000 annual shortfall, museum executives propose either to donate the collection to the British Library, or to move a reduced collection to accommodation at a disused airfield in Wiltshire.

Either option would drastically limit public access. At present, there is free entry to the public. Ask at the barrier just inside the Imperial College Library main entrance, and you will be issued with a pass for the day. Present proof of identity and address at the Science Museum Library desk, and you will be issued with a period ticket free of charge. An impressive collection of books and periodicals is on open access, so you can browse, and keep up-to-date with the world's scientific and technical literature. It is of course a reference, not a lending library. The staff are very helpful.

Sadly, this superb library available free and without formality to the general public may become much less accessible, in the way that the splendid former Patent Office Library was at Chancery Lane. The Patent Office Library is now part of the British Library, which can be used only by those able to get a ticket.

Use the Science Museum Library while you can!

Source: Mark HENDERSON, 2004, Black hole in finances may mean the end for science library. *The Times*, 14 September 2004, 12 - 13.

Further news of the Science Museum Library

Proposals to disperse the Science Museum Library's contents (Reported above) are still under consideration. Most of the printed material would be absorbed, at the existing site, by the Imperial College Library. Other materials, especially archives, transferred to the British Library. And a small core collection retained by the Science Museum, presumably back in their own premises. The immense value of this collection is that it is available and accessible to the general public without charge, and with minimal formalities, and open weekday evenings and Saturdays. Much of the printed and published material is on open access shelving, so browsing is possible. It is of course a reference-only library. It is especially important that this material should remain readily accessible to the general public without charge of formality, especially as the contents of the former Patent Office Library have now been swallowed up by the British Library at St. Pancras. The old Patent Office Library was open to all (reference only, again, of

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course) without charge or formality until 9 p.m. every weekday. Quite apart from the patents, it held all the world's most important technical periodicals and reference books - the last five years' worth of periodicals and most recent books all on open access, and all the older material available to order. This is now all at St. Pancras, where it can be quite a challenge to get a reader's ticket, and the scope for browsing material on open access shelves (although still impressive) is somewhat reduced.

Members of Subterranea Britannica having a serious interest in research, at whatever level, or simply satisfying their curiosity, are urged to explore and use the Science Museum Library. You will also be able to use (reference only) the resources of the Imperial College Library. Even reference-only use of the main University of London Library at Senate House, Malet Street, now attracts a hefty fee! So the splendid outfit at South Kensington is fully deserving of all our support, and one of the great highlights of London's intellectual and cultural scene. Use it - don't lose it!

Source: Brian STRONG, 2005, Science Museum Library. *Newsletter Greater London Industrial Archaeology Society* 218, 6 - 7.

The proposed Red Sea - Dead Sea Canal

A canal to link the Red Sea to the Dead Sea (the latter, at 400 metres below the former, being the lowest point on the earth's surface) have been discussed from time to time since the 19th century.

At first, a conventional 176 kilometre transportation canal was in view. Currently, a combination of open channels, tunnel, and pipeline is under consideration as a means of generating hydro-electric power, and of supplying drinking water.

Some of the electricity generated would be used to power one or more desalination plants, and to pump sea-water from Aqaba up to 170 metres above sea level to cross intervening high ground. Canal-side holiday resorts may also be built in what is now desert.

Although the proposed route lies just inside the Jordanian border with Israel, an international scheme in which Jordan, Israel and Palestine collaborate is envisaged. The annual available water per head of population in these countries is 140 cubic metres (Jordan), 340 (Israel) and 70 (the Palestinian Authority), compared with the UK figure of 1,500 cubic metres per head per annum. Water shortage, and competition for water, is (in default of co-operation) seen as as much a potential cause of future international tension and conflict as has been the case with oil in the past.

The land-locked Dead Sea, ten times as saline as normal sea-water, is drying up, its level falling at present by about 0.8 metres per annum.

Source: Conal URQUHART, 2005, Peace canal deal for thirsty Middle East. *The Guardian*, 9 May 2005, page 18.

NEWS - MUSEUMS

National Coal Mining Museum for England, Caphouse Colliery, near Wakefield, West Yorkshire

In a continuing series of appraisals of mining-related museums, Chris Jones, writing in the caving magazine *Descent*, turns his attention to the Caphouse Colliery museum near Wakefield. This comprises surface buildings and artefacts and displays, a descent of a genuine mine-shaft in a miners' cage, and a short underground tour.

He reports considerable improvements since his last visit, since when there has been significant investment and entrance fees have been abolished. His main comment is that although officially the National Coal Mining Museum for England, Caphouse has every appearance of being little more than the coal-mining museum for Yorkshire, with only token acknowledgement that other parts of the country (even Kent) had important mining areas. And he felt that there should have been some account of the still sensitive question of the 1980s strike and the following wholesale pit closures: regrettable, as was the War, but impossible to ignore that it happened. Big Pit, in South Wales, he concludes is still the best coal-mining museum in the UK.

Source: Chris JONES, 2005, The National Coal Mining Museum for England. *Descent* 184, page 33.

The water tunnels at Exeter

Malcolm Etherington, of the Wealden Cave and Mine Society, has described a recent visit to the ancient water-supply tunnels below central Exeter, about 300 metres of which have been open to public visits since the 1930s, although the system is now closed for about 18 months from December 2004 while re-development takes place in the city centre above.

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A system of lead pipes tapping springs and wells commenced in the 1170s, serving the Priory of St. Nicholas, and eventually many of the pipes were re-laid in cut-and-cover tunnels allowing access for repairs without the necessity of digging up the roads. In 1642 the tunnels were blocked off, after the lead pipes had been ripped out to make bullets during the Civil War.
The whole system was finally abandoned in 1832 when Exeter's first 'modern' mains water supply was opened. The passages are about shoulder-width, and almost high enough to stand upright in (a comfortable height for the vertically challenged.)
Source: Malcolm ETHERINGTON, 2005, Exeter's tunnels. *News of the Weald* 58, 1 - 2.

Cleveland Ironstone Mining Museum, Skinningrove

The mining museum at Skinningrove, Cleveland, is the only one in the country featuring ironstone mining. At its peak in the 19th century Cleveland had 82 mines, producing nearly seven million tonnes of ore a year. A 30-minutes black-and-white film *Demonstration day* has been produced, shewing mining and mining-related scenes in the 1860s.

Source: Chris JONES, 2005, Filming ironstone. *Descent* 184, page 33.

Rosedale branch railway and ironstone mines display, Beck Isle Museum, Pickering

The Beck Isle Museum at Bridge Street, Pickering, near the North York Moors Railway station, has a display on the Rosedale branch railway and ironstone mines, open daily until the end of October. Further details are at www.beckislemuseum.co.uk .

Source: Chris JONES, 2005, Rosedale's mines. *Descent* 184, page 33.

German underground works in Guernsey and Jersey, Channel Islands

Peter Tabb has described publicly-visitable World War II underground works created by the occupying Germans in Guernsey and Jersey, including tunnel systems refurbished and reopened in conjunction with the Islands' celebrations of the 60th anniversary of their liberation. Three sites on each island are noticed - La Valette Underground Military Museum (Ho4 and Ho8), the Underground Hospital, and Ho12 on Guernsey; and Gibraltar, Jersey War Tunnels (Ho8) and Ho1 on Jersey. Ho stood for Höhlgangsanlagen or 'cave passage installations.' His book *A peculiar occupation: new perspectives on Hitler's Channel Islands* was published by Ian Allan in 2005 [ISBN 0-7110-3133-4] contains further details of the underground works.

Source: Peter TABB, 2005, Descent into the peculiar. *Descent* 184, 34 - 35.

Cape Coast Castle, Ghana

Cape Coast Castle, on the coast of Ghana (formerly the Gold Coast), offers guided tours illustrating the building's rôle in the slave trade. The relatively spacious upper rooms, reached via a grand staircase, include the Governor's Room, offices, and the auction room where slaves were sold. Here there is an exhibition outlining the mode of operation of the slave trade. Thirty-three ships annually were setting out from Liverpool by 1740, carrying exports for sale to Africa. At places such as Cape Coast Castle, the goods sold, they took purchased slaves on board, of whom an estimated 13 million made the one-way Atlantic crossing in appalling conditions on board. Of these, at least a proportion reached the other side. On one notorious occasion in 1781 the master of a Liverpool ship dumped more than 100 sick slaves overboard in mid-Ocean, and claimed their cost under the insurance policy. When the slave ships reached the North American coast, the slaves were sold on, and coffee and sugar purchased for sale on return to Liverpool.

The lower parts of the castle, visited during the course of guided tours, are cavernous cellars cut into the bedrock where slaves were 'stored.' A visitor in 1682 praised this underground slave-holding facility, and commented that it was 'cut out of the rocky ground, arched and divided into several rooms; so that it will conveniently contain a thousand Blacks, let down at an opening made for the purpose. The keeping of slaves thus underground is a good security against any insurrection.'

There are parallel public displays explaining the slave trade at museums at Liverpool, and at Monticello, Virginia.

Source: Jonathan JONES, 2005, *The Guardian Review*, 30 June 2005, 14 - 15.

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Record-breaking tunnels for China, Norway, and Turkey

Work has started on the Eiksund road tunnel in western Norway, and preparations are at an advanced stage for the Chongmin road tunnel in China, and the Marmaray rail tunnel in Turkey. All three are vast and ambitious under-sea works.

At Eiksund, a 7.765km long single-bore two-lane road tunnel is being driven below Vartdalsfjord, with 1.2 km already drilled and blasted through hard banded gneiss. At 50m per week, it will take more than 15 months for the tunnel to reach its deepest point, nearly 300m below the surface of the fjord. It will, when completed, be the world's deepest under-sea tunnel. The minimum depth of rock between the tunnel ceiling and the bottom of the fjord will be 50 metres. There will be no refuges or escape tunnels, but the two-lane tunnel will widen to three lanes where the gradient nears 10%, to allow three-point turns for vehicular escape in emergencies. In all, three turning points will be provided for heavy goods vehicles, and 15 for smaller ones. The two-lane sections will be 6.5m wide, and the three-lane sections 9.5m, in each case with 4.6m below the ceiling-mounted ventilation system. Opening to traffic is expected in 2007.

The Chongming road tunnel, near Shanghai, will eliminate a ferry crossing on the 25 km Chongming - Shanghai Expressway, and will be the largest ever bored tunnel, and amongst the largest tunnels of any kind worldwide. It will have twin bores, each of 15m diameter, nine kilometres long. Chongming is China's third largest off-shore island. The twin bores will be linked by emergency escape cross-passages. Each bore will have three lanes, with a fourth for emergency vehicles below the main highway deck.

In Turkey, the Marmaray tunnel will link the railways of Asiatic and European Turkey below the Bosphorus. With its deepest point 60m below the sea, this will be the World's deepest immersed-tube tunnel. The 1.8km immersed tube section will link conventional bored tunnels either side. The bored land tunnels will total 12km, and the project will include upgrading the existing suburban rail networks either side of the straits.

The technical difficulties of emplacing immersed tube sections across the Bosphorus are immense, as are the problems of connecting the immersed tube section to the land bores. The sea bed is 'very soft and prone to liquefaction during earthquakes' so 'it will have to be improved' before emplacement commences. The very busy waterway has particularly strange currents and variations in salinity at depth. The Black Sea is some 0.75m higher than the Sea of Marmara, resulting in a surface outflow of less-dense brackish water southwards. Above the sea bed, a contraflow of more saline water is driven northwards by the density difference. A turbulent zone lies between the two opposed currents. The tunnel segments, up to 90m long, will have to be lowered through the water, and precisely lined-up with each other on the planned route. The twin bores are proposed to be within single concrete box units about 15.22m wide and 8.65m high. Emergency escape doors may be provided at intervals linking the bores.

The Bosphorus, linking the Black Sea with the Sea of Marmara, is 649m wide at its narrowest point, and has been bridged since 1973, with a main bridge span of 1074m.
Presumably, although the tunnel-laying operations will have to avoid, or be avoided by, shipping, there should be few problems with Russian submarines passing this way in modern times!

Source: David PARKER, 2005, Tunnelling record-breakers. *New Civil Engineer*, 3 February 2005, 18 - 20.

CABLE TUNNELS

20km Cable tunnel from Elstree (Hertfordshire) to St. John's Wood (London) nearing completion

A National Grid spokesman, commenting on the proposed 10 km Croydon cable tunnel, is quoted as reporting that 'We are in the throes of finishing a 20 km tunnel running from Elstree, in Hertfordshire, to St. John's Wood, in North London.

Source: Emily ATTWOOD, 2005, Giant tunnel to carry town's power. *Croydon Advertiser*, 25 February 2005, page 5.

A lost tunnel at Caversham (Reading)

In the middle of the 19th century a school known as Caversham House Academy stood in Church Street, Caversham (the part of Reading, once Oxfordshire, north of the Thames.) The site is now the St. Martin's Shopping Precinct, built in the late 1960s. The Academy is said to have been linked by a tunnel under the road with a playground opposite, the site of which is now occupied by the Caversham Free Public Library, erected there in 1907. Source: caption to photograph

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displayed on the wall in a public house in Prospect Street, Caversham.

RAILWAY TUNNELS

Terrorists' bombs explode in London Underground tunnels

Bombs exploded at three locations of London Underground lines and on a London bus within an hour during the morning of Thursday 7 July 2005. By the following day, the difficult, dangerous, and extremely unpleasant business of accessing the sites, rescuing the injured, and retrieving the dead had led to estimates of at least 38 dead, a figure which increased to more than 50 over the following days.
At 8.51 the first bomb exploded on a Circle Line train which had just departed from Aldgate towards Liverpool Street, 100 yards into a tunnel. At 8.56 there was another explosion, on a south-bound Piccadilly Line train in a deep-level tunnel between King's Cross and Russell Square. The third bomb exploded on a westbound Circle Line train which had just left Edgware Road station for Paddington. A second train, travelling in the opposite direction, ploughed into wreckage blown onto the eastbound track. The final blast of the day occurred on a number 30 Hackney to Marble Arch bus on a diversionary route through Tavistock Square.

By 22 July the death toll resulting from the four explosions had reached 56 persons (including the four suicide bombers themselves.)

On Thursday, 21 July, there were alarms and station closures at Kennington, Oval, Shepherd's Bush, and Warren Street stations, and services on the Bakerloo, Hammersmith & City, Northern, and Victoria Lines were suspended, as were parts of the Midland Mainlne and Thameslink lines. Up to four would-be suicide bombers were thought to be on the run, and explosives left on a bus and three underground trains failed to explode as a result of faults with the detonators. On Friday morning, 22 July, a suspected terrorist bomber was chased into Stockwell tube station, onto a crowded train, and shot dead by police. Unfortunately it transpired that the dead man was a 27-year old Brazilian electrician, Jean Charles de Menezes, with nothing whatsoever to do with the suicide bombings.

Source: Ian COBAIN, Richard NORTON-TAYLOR, and Rosei COWAN, 2005, On the run last night: four would-be suicide bombers. *The Guardian*, 22 July 2005, 1 - 6.

Source: Richard EDWARDS, et al., 2005, Bomber is shot dead on the tube. *Evening Standard* [West End final edition], 22 July 2005, pages 1 - 13.

Source: Hugh MUIR, *et al.*, 2005, London's day of terror. *The Guardian*, 8 July 2005, 1 - 14.

Source: ANON, 2005, Terrorists hit London's transport. *Modern Railways* 62(683), page 5.

Gerrards Cross 'tunnel' collapse, Buckinghamshire

Some 30 metres of the new 320 metre 'cut-and-cover' railway tunnel at Gerrards Cross (Buckinghamshire) on the former Great Central main line, and still an important route from London Marylebone to Birmingham Snow Hill, collapsed on Thursday night, 30th June, shortly after a northbound commuter train had passed through. About 5,000 tonnes of fill landed on the railway line about 80m from the southern portal, resulting in an emergency stop by an approaching train. The structure, south of Gerrards Cross Station, is not a true tunnel, but a covering-over of a railway cutting. The structure was intended to support a new Tesco supermarket and / or its car park. Photographs of the tunnel under construction and after collapse published in *The Guardian* make it clear that the structure was of what appear to be 400 rather slender concrete arches above a span wide enough to accommodate the two running lines and a more or less equal space perhaps representing one or two more lines now lifted. The space above the arches was, it seems, being filled up to ground level with loose earth and rubble and power station ash. This seems an inherently less reliable means of construction than the more usual way of building structures above railway property, viz. piles, reinforced concrete columns, and reinforced concrete beams supporting a deck. It has been suggested that the arches were insufficiently strong to bear the weight of the loose fill, much increased after recent rain.

The development had been opposed by three local councils and 93% of local residents on planning and amenity grounds.

Source: Sam JONES, 2005, Tunnel collapse puts £ 20m store in doubt. *The Guardian*, 1 July 2005, page 5; and Mark HONIGSBAUM, 2005, Corks pop after tunnel collapse. *The Guardian*, 2 July 2005, page 11.

Source: ANON, 2005, Tesco tunnel collapses at Gerrards Cross. *Modern Railways* 62(683), page 5.

Cairngorm funicular railway tunnel,

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The Cairngorm funicular railway, a visually less intrusive addition to the mountain landscape than most ski lifts, has a road link from the mainline railway station at Aviemore, and was opened to traffic on 24 December 2001. With a two metre gauge, this is the widest funicular railway track in the world. The two carriages, each 3.2m wide and 10.5m long, can carry 120 skiers and snowboarders in winter. In the summer there is seating for 48 passengers, with another 30 allowed to stand. The wide gauge allows the line to be operated safely in the notoriously strong winds on the Cairngorms, even up to 85 mph, although as a matter of policy the operating company closes the line when wind speeds approach 60 mph.

The line is 1,950 metres long, of which 247 metres near the summit is in tunnel. The steepest grade is said to be 22 degrees (1 in 4) and speeds of up to 36 kph are reached.
The line is in a World Heritage Site, containing rare and scientifically important plants, surviving in a harsh climate representative of sea-level conditions 700km further north, or Ice Age conditions at the latitude of Aviemore 15,000 years ago. The railway was built as part of measures to protect the ecosystem, and visitors to the summit (where there is a restaurant and bar) are allowed away from the line only when the ground is protected under snow, when they can ski.

Source: Alan PIKE, 2005, Cairngorm funicular. *Newsletter National Council on Inland Transport* 22, 2 - 3.

Old Standedge railway tunnel to be used for access for repairs to the new one on the Leeds - Manchester main line

The earliest of the Standedge railway tunnels, Standedge Down South, was built under the Lancashire - Yorkshire border in 1846 - 49 for the Huddersfield Railway and Canal Company, with a single line in a three miles 62 yards bore between portals close to Marsden and Diggle Stations. The driving of this tunnel was made considerably easier by the existence of the earlier canal tunnel alongside. Cross-passages from the canal tunnel allowed access for men and materials along the length of the new bore.

A second single line tunnel, Standedge Up South, of the same length, was built alongside in 1868 - 70. The centreline of this is some 25 feet south of that of the earlier railway tunnel. Again, construction was made easier by the driving of six or more cross-headings, this time from the older rail tunnel.

The single-track tunnels have been out of use for some years, but are now being brought back into use to allow access for men and materials for repairs to the double-track tunnel and its running lines. The currently active tunnel has developed distortions at two points, with instrumented displacements of up to 15mm since 1998.

The double-track tunnel now in use, Standedge North (three miles 64 yards) was made in 1890 - 94, again, construction was facilitated by the possibility of further 15 feet wide cross-passages from the earlier tunnels.

As a result of the use of the cross-passages between the canal and the three railway tunnels during construction, none of the railway tunnels has any shafts (which, contrary to popular opinion, are primarily for access and spoil removal, not for ventilation.) The cross-passages eliminated the need for engines and machinery to lift tunnel spoil from the tunnels during driving, as this could go out via the earlier tunnels each time. The canal tunnel, however (recently reopened to traffic) was driven (1794 - 1811) conventionally, from headings in both directions from the bottoms of eight shafts as well as from the portals. The remedial measures being taken are described and illustrated by Bernadette Redefine in a recent issue of the *New Civil Engineer*.

Source: Bernadette REDEFINE, 2005, Tunnelling: Pennine ways: engineers are rescuing a 19th century railway tunnel running deep under the Pennines. *New Civil Engineer*, 27 January 2005, 20 - 21; historical details from Alan BLOWER, 1964, *British railway tunnels* (Ian Allan), pages 24 - 27.

Chinese trains in British tunnels?

A study of British transport infrastructure suggests a new London to Glasgow express railway line equipped with Maglev trains based on those currently operating at Shanghai Airport. The airport trains take eight minutes to travel their 19 mile track, the same journey by car taking an hour! Britain's hilly topography is, it is suggested, very suitable for Maglev operation, as trains on the new system can tackle gradients as steep as 10% against a conventional rail limit of 4%, thus calling for less investment in earthworks. A new line might go via Birmingham and Manchester, pass under the Pennines in existing but disused tunnels, and then to Leeds, Newcastle, and the west coast route to Edinburgh and Glasgow.

Source: Andrew CLARK, 2005, China's 270 mph flying

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train could run on London to Glasgow route if plan takes off: study shows £ 16bn line could relieve transport chaos. *The Guardian*, 6 June 2005, page 3.

London Underground Northern Line closures for maintenance proposed

London Underground is considering plans put forward by upgrade contractors Tubelines for long-term closure of Northern Line tunnels to speed up maintenance.

Closing entire sections of the line for an extended period would allow maintenance to be completed more quickly, rather than as at present working only in the small hours, between the last train at night and the first the next morning. London Underground Limited has yet to decide whether or not to adopt this course.

Source: Antony OLIVER, 2005, Long term Northern Line closures could speed tube maintenance. *New Civil Engineer*, 10 March 2005, page 5.

Moving Block signalling to allow London Underground trains at 60 miles an hour and 300 yards apart?

A new signalling system, the 'moving block' system, trialled on a 900 yard test track built beside the Northern Line at Highgate in north London, is expected to allow London Underground trains to travel at up to 60 mph and less than 300 yards apart. Existing lineside colour light signalling will be removed, and the train will operate automatically, the driver simply checking the train doors *en route*. The new system will be installed first on the Jubilee Line. Minimum distances between moving trains will be reduced from 700 to 280 yards, and they will be able to accelerate and brake more rapidly, leading to shorter journey times. Trains will be guided by signals picked up from cables laid between the tracks. The system will calculate every train's position to the millimetre, every 0.7 seconds. Computers will calculate and dictate speeds, acceleration, deceleration, and braking to allow the quickest possible overall speeds whilst avoiding collisions with preceding or following trains. In the event of any system failure, trains will be stopped by automatic application of the brakes. A similar system is already in use on the driverless Docklands Light Railway, although (presumably as a result of tighter curves and steeper gradients) speeds are lower. Drivers will be retained on London Underground trains simply to reassure passengers. From 2009 the Jubilee Line is expected to be able to handle 33 trains each hour, compared with the present 24. On the Northern Line, from 2011, trains will be increased from 30 to 35 trains each hour. Similar systems are already operating on Metros in Ankara, Hong Kong, San Francisco, and Vancouver.

Source: Ben WEBSTER, 2004, High-speed trains to squeeze delays for passengers on the London Tube. *The Times*, 12 October 2004, page 8.

London Underground Oxford Circus Station maintenance

Oxford Circus Station, with platforms on the Bakerloo, Central, and Victoria lines, sees twice as many passengers in a year as all of London Heathrow Airport's terminals combined. Work is currently in progress upgrading the 5.6 km of station tunnels, platforms, and corridors, with no closures to passengers. All work is being done between the station's closing time (12.40 am) after the last public service train has gone, and 04.30 a.m. when the first early morning passengers are admitted. LULL engineering trains continue to run through the three sets of station tunnels. The only thing the public are likely to notice of all this is the early closure of one of the station exits (exit 8), to allow for delivery of materials, as lorry deliveries are banned in London after midnight. One of the contractors' difficulties, reportedly, is the lack of plans identifying the vast numbers of cables running around above false ceilings and elsewhere.

Source: Antony OLIVER, 2005, London Underground: overnight transformation. *New Civil Engineer*, 10 March 2005, 21 - 22.

London Underground's King's Cross Station new northern ticket hall

Transport Minister Tony McNulty has given the green light for work to proceed on a new northern ticket hall for the reconstructed King's Cross underground station, a part of the redevelopment which had been put on hold in January 2004. The station is being rebuilt as a result of more comprehensive re-development in connection with the new Eurostar trains terminal at adjoining St. Pancras main line station, and in the light of recommendations following the disastrous fire of 1987.

Source: ANON, 2005, King's Cross northern ticket hall to go ahead. *New Civil Engineer*, 17 February 2005, page 11.

Thameslink's new Kings Cross St.

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Pancras Station box completed - but not yet fitted out and in use

A new concrete box, through which the Thameslink railway lines and trains are now running, has been completed for the to-be-relocated Kings Cross Thameslink Station. However, passengers will have to be content with the awkwardly sited existing station in Pentonville Road for some while yet, as approval for funding for fitting out the relocated station had not been secured in time to have it ready for the resumption of through-running of trains earlier in 2005.

Source: ANON, 2005, Let's make it Thameslink 2011. *Modern Railways* 62(683), page 4 [includes a photograph of the interior of the station box]

London Underground power failure closes 10 stations during the rush hour

On Tuesday evening, 17 May, an unexpected 'power surge' on London Underground resulted in the failure of electrical lighting and escalators at stations on all or parts of the East London and Metropolitan lines, including King's Cross and Westminster. The Metropolitan line was suspended between Moorgate and Aldgate for an hour and a half from 18.00 onwards. Caledonian Road, Camden Town, Hampstead, King's Cross, Mornington Crescent, Oxford Circus, and Seven Sisters all reopened within an hour, but Angel and Warren Street were closed until about 19.45.

Source: Katharine BARNEY, 2005, Chaos as underground bosses are forced to close 10 stations in rush-hour: massive tube power failure hits thousands of commuters. *Evening Standard*, 18 May 2005, page 4.

The proposed Crossrail tunnels under London: a threat to buildings?

An article in *The Guardian* (2 April 2005) has suggested that driving the two proposed main line railway tunnels for the Crossrail project (linking the main lines at Paddington with those as Liverpool Street) might endanger a number of 'architectural gems' as a result of ground settlement. Buildings above the intended route include the London Palladium (Argyll Street), Centrepoint and the Astoria Theatre (Tottenham Court Road), Sicilian Avenue (Southampton Row), the Smithfield Market buildings, the Barbican (Defoe House), Britannic House (Finsbury Circus) and Spitalfields, where a construction shaft is intended.

Those inclined to see this as a cause for concern may like to consult the two-volume work, *Building response to tunnelling: case studies from construction of the Jubilee Line Extension London* (ed. J.B. BURLAND, J.R. STANDING and F.M. JARDINE (Thomas Telford, 2001.)) Or, of course, the several accounts of the tunnel-lining cracking and subsidence associated with tube tunnels at Heathrow in 1986, and partial collapse of the Heathrow Express tunnels in 1994!

Source: Robert BOOTH, 2005, Crossrail plan threatens architectural gems. *The Guardian*, 2 April 2005, page 9.

London Crossrail's intended route, tunnels, and permanent shafts

Details have been published of the proposed underground infrastructure of the Crossrail scheme for London. This is intended to allow full-size main-line loading gauge trains to run below central London, linking the main lines west of Paddington with the eastbound lines out of Liverpool Street. Brussels had its first through main lines below its city centre as long ago as 1952, of course, so this is something of a catching-up exercise for the British!

The new works comprise one long new tunnel, Paddington to Stepney Green where it will bifurcate to serve the eastern (Stratford) and south-eastern (Plumstead) branches. The south-eastern branch will follow an existing tunnel between Custom House and North Woolwich, and have a new tunnel under the Thames between the North Kent line near Plumstead.

What is proposed, from west to east, is as follows:

The main Great Western - Great Eastern line

Feature	Location
Crossrail train start points	Maidenhead and Heathrow
Western portal	Between Acton Main Line and Paddington Stations
Shaft	Royal Oak
New sub-surface station	Paddington
Shaft	?
Shaft	?
New sub-surface station	Bond Street

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New sub-surface station	Tottenham Court Road
Shaft	Fisher Street
New sub-surface station	Farringdon
New sub-surface station	Liverpool Street
Shaft	Hanbury Street
Temporary spoil extraction conveyor tunnel link	Hanbury Street to Pedley Street
Temporary spoil extraction shaft (off line of main rail tunnel)	Pedley Street (spoil extraction point)
New sub-surface station	Whitechapel
Shaft	Stepney Green

[Beyond Stepney Green a south-eastern branch diverges - details below]

Shaft	?
Shaft	?
Eastern portal	Pudding Mill Lane just east of Stratford Station
New depot	Romford
New terminus	Shenfield

The South-Eastern branch beyond Stepney Green

Feature	**Location**
Shaft	?
Shaft	?
New sub-surface station	Isle of Dogs
Shaft	?
Shaft Eastern portal	Limmo Peninsula Victoria Dock
New surface station	Custom House
Existing docklands tunnel north portal	?
Existing docklands tunnel	?
Existing docklands tunnel south portal	?
New Thames tunnel North portal	North Woolwich
Shaft	Woolwich
Shaft	?
New Thames tunnel south portal	Plumstead
New terminus	Abbey Wood

With the exception of three underground lines in the Oxford Street area, the new Crossrail tunnels will pass below existing tube lines and other structures.
Seven new sub-surface stations are planned, all linked by a pair of single-track tunnels, at Paddington, Bond Street, Tottenham Court Road, Farringdon, Liverpool Street, Whitechapel, and Isle of Dogs. Most stations on the line will offer connections to other lines.

The sort of service proposed appear to be closer in concept to that on the Paris RER (Réseau Express Régional) system linking fast suburban services either side of the city, rather than Brussels' through main-line services such as Paris - Brussels - Amsterdam and Köln.

Source: James ABBOTT, 2005, Crossrail in the Parliamentary process. *Modern Railways* 62(681), 28 - 33.

The Channel Tunnel Rail Link (Section Two: Southfleet to London St. Pancras)

The Channel Tunnel Rail Link (CTRL) Section 2 (Southfleet to London St. Pancras) is due for completion, with through Eurostar trains to and from Brussels and Paris commencing in 2007. Tunnelling is now complete, and tracklaying almost complete. Signalling equipment remains to be put in place, and stations fitted out.
Associated work at St. Pancras features, amongst other things, improvements to the cross-London Thameslink service, with trains running between Bedford and Brighton, serving also Luton and Gatwick

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Airports, and East Croydon (probably the country's busiest station outside central London.) The new 'Thameslink box' was completed in May 2005. This is the shell for a new Thameslink station to serve King's Cross and St. Pancras Stations, to replace the existing awkwardly sited King's Cross Thameslink Station in Pentonville Road. The concrete box is 400m long, 23m wide, and 11m deep, and occupies the site of a former brick-lined tunnel. Northbound Thameslink services have terminated at Kings Cross Thameslink, and southbound ones at West Hampstead Thameslink, while the box was being constructed. With the resumption of through running (from 16th May 2005), trains will for a while continue to stop at Kings Cross Thameslink (and run through the new box without stopping) while funding for fitting out the replacement station are secured.

Source: ANON, 2005, CTRL progress. With the Thameslink box now finished, tracklaying is nearly complete on the Channel Tunnel Rail Link's Section Two, Southfleet to St. Pancras. *Modern Railways* 62(681), 40 - 42.

Death of Colin Kirkland [1936 - 2004] - Eurotunnel Technical Director

Colin Kirkland, best known as Technical Director for Eurotunnel, died of cancer at the end of 2004. He had been involved with work in connection with the Channel Tunnel project since 1965. Other projects in which he was professionally engaged included London's Post Office tunnels, and the Victoria and Jubilee lines. He was Chairman of the British Tunnelling Society, 1985 - 87, and President of the International Tunnelling Association, 1987 - 92.

Source: ANON, 2005, Channel Tunnel champion Colin Kirkland dies. *New Civil Engineer*, 6/13 January 2005, page 12.

New Lötschberg base railway tunnel bores holed-through (Switzerland)

The existing high-level, and thus relatively short, Lötschberg railway tunnel is in process of being by-passed, by a double-bore base-tunnel 500 metres lower, eliminating steep approach gradients for long-distance trains. The Base tunnel is 34.6km long, and was holed-through on 15 March 2005 (west bore) and 28 April 2005 (east bore.) The existing high-level tunnel will be retained in use for the car-shuttle.

Source: ANON, 2005, Switzerland: Lötschberg breakthrough. *Modern Railways* 62(682), page 63.

Proposed subsurface Porta Alpina Station within the new Gotthard Base Tunnel, Switzerland

A passenger station within the length of the new Gotthard base railway tunnel is proposed, to serve a surface station building on the mountainside above, in the Disentis - Sedrun area. The underground and surface parts of the new station will, if approved, be linked by lifts in a refurbished existing access shaft to the new tunnel. Journey times for tourists from Zurich could be halved.

Source: ANON, 2005, Switzerland: Gotthard Tunnel station. *Modern Railways* 62(683), page 62.

Collapse of apartment blocks into the Barcelona Metro

Two apartment blocks in Barcelona collapsed on 27 January 2005 as a result of undermining in the course of driving new tunnels for an extension to the city's Metro system, rendering more than 50 families homeless. A surface cavity 25 to 30m deep and 30m in diameter formed at the site. Doubts have been expressed about continued use of the New Austrian Tunnelling Method (NATM) , and 'open-face' method of tunnelling in which temporary support is provided by concrete sprayed onto rock-bolts, before a permanent tunnel lining is installed. The tunnel collapse at London Heathrow Airport in 1994 also featured sub-surface railway tunnels driven by the NATM. Blame at Barcelona has also been directed at the notion of a 'hidden' fault (one not detected in advance by site investigation) in the 'relatively mixed old weathered slate and very old metamorphic siliceous ground' (not a strictly correct geological description!) at the site. The vertical site investigations all missed the vertical fault.

Source: Adrian GREEMAN, 2005, Barcelona Metro collapse prompts NATM review. *New Civil Engineer*, 17 February 2005, page 10.

Bored tunnel to be driven in Singapore after cut-and-cover failure

Construction of Singapore's Mass Rapid Transit Circle Line, held up by the catastrophic collapse of a cut-and-cover section of a 1.9km partly bored line in April 2004, is now to continue, with 1.8km twin-bored tunnels instead. The originally intended tunnel alignment is abandoned. Four construction workers died in the collapse. The affected part of the line is

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between the Millenia and Boulevard Stations, and will pass under the Kallang Basin, to the south of the collapse area. Also re-sited will be the Nicoll Highway station, just to the west of the collapse. Ground conditions on the new alignment, as on the abandoned route, include 1950s fill and made ground overlying 50 to 60m of soft marine clay. Two new tunnel-boring machines will drive westwards from near Boulevard Station to the receiving shaft at Millenia, starting in Summer 2005.

Source: ANON, 2005, Singapore opts for bored tunnel after cut-and-cover failure. *New Civil Engineer*, 17 February 2005, page 10.

Tunnelling in Hong Kong's New Territories, China

Hong Kong Island, Kowloon, and the New Territories returned to Chinese administration on 1 July 1997, since when there has been no slowdown in civil engineering projects. There are two lines northwards through the New Territories towards the old Chinese frontier, one of them running through to Guangzhou and its airport in Canton. The East and West lines are now being linked to create a complete rail loop, with branches serving peripheral settled areas. The Kowloon Southern Link, to be completed by 2009, will link existing lines at East Tsim Sha via a bored tunnel with those at Nam Cheung. The Northern Link and the East Rail Spur Line, much of them in tunnel, will connect Lok Ma Chau and Lo Wu with the main loop. The Northern Link has been particularly problematic, as concern for the marshland environment and its birdlife (they evidently do care about such things in China) dictated that a planned viaduct had to be replaced by a tunnel. Site investigations in the sensitive Mai Po wetlands (home to about 60,000 migratory birds) had been limited to test borings sufficient only for the emplacement of viaduct piers. Tunnelling is through decomposed volcanic soil overlying a mixture of hard rock and soft ground. 98% of detected settlement readings have been less than 25mm - a triumph for the engineers - and water-levels in the marshes have not been materially depleted. Three 4.4m diameter cross-tunnels, 7.8m long, link the twin bores. These were made by freezing the intervening soft ground with brine cooled to minus 35° Celsius, and then breaking it out with jack-hammers. The cross-tunnels are then lined before the ground temperature warms up again. Other tunnelled parts of the links completing the loop are made by cut-and-cover techniques.

Source: Ruby KITCHING, 2005, The water margin. *New Civil Engineer*, 10 March 2005, 26 - 28.

The Moscow and Paris Metro Systems

An illustrated feature article in *The Daily Telegraph's Travel Supplement* recently featured the Metro systems of Moscow and Paris as tourist attractions in themselves. The Moscow system boasts trains every minute, and more frequently in the rush hours, and claims they run at up to 56 mph, without any stops for signals in tunnels. Although a Moscow Metro was first proposed in 1902, and again in 1912, work on the system was not commenced until 1931. It is still expanding, with the new Lyublinskaya line currently under construction. At present there are 165 stations on 11 lines, and 270 km (169 miles) of operating tracks (presumably route miles.) The ornate subterranean stations are described in some detail. As in London, parts of the Metro saw alternative use during World War II. Mayakovskaya Station, built in 1938, named after the poet Vladimir Mayakovsky, is one of the largest stations and was used in the war as the Headquarters of the Moscow Anti-Aircraft Defence Forces.

Source: Nadine MOISTER and Andrew MARTIN, 2005, Going underground. *The Daily Telegraph Travel*, 2 April 2005, 7 - 9.

USA National Transportation Safety Board verdict on Baltimore railway tunnel fire of 2001

On 18 July 2001 there was a fire in the 2.72km Howard Street railway tunnel in Baltimore, USA. Eleven of 60 tankers on a 101m long freight train were derailed within the tunnel, possibly by an obstruction on the line, although this has not been ascertained for sure. A tankerful of the hydrocarbon tripropylene was ruptured, and the escaping material caught fire. This resulted in damage to and spills from two tankers of hydrochloric acid, and a third tanker of di-(2-ethylhexyl)-phthalate (a plasticiser.) Shortly afterwards, a 1.25m water main above the tunnel ceiling burst, resulting in flooding. The resulting mess made it impossible to gain access to the wrecked trains and undamaged container vehicles for several days.

Although the tunnel is owned and the train was operated by a firm called CSX, the City of Baltimore was apportioned some of the blame by the National Safety Transportation Board, as the *City's Hazardous Materials Action Plan* contained no provision for the kind of event that occurred on this occasion. There was a lack of accessible information on fire-fighter access points. CSX, in its turn, was criticised for failing to keep records of tunnel repairs and maintenance.

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The City's fire department, at the time, said that they had no plan in place for such an accident, as it was felt that the likelihood of an accident involving a train derailment in the tunnel, fire, chemicals leakage, and burst water main was too remote a possibility to be worth planning for.

Source: Andrew BOLTON, 2005, Baltimore and tunnel operator criticised over toxic blaze. *New Civil Engineer*, 6/13 January 2005, page 16.

New sub-surface main railway station and approach tunnel at Auckland, New Zealand

The original main railway terminus in Auckland was re-located to a less convenient and central site, 1.5 km out of the centre, in 1929, and in 1937 replaced by a central bus station and car park. With about a third of New Zealand's population of 3.7m persons living in and around Auckland, traffic congestion is now becoming a major problem, and better and more integrated public transport infrastructure a priority.

The railway is now diverted back to the former terminus site, but at a lower level by way of a 500m cut-and-cover approach tunnel. The new sub-surface station, with five platforms, was completed in July 2003, and is built in a concrete box about 300m long, 45m wide, and 12m deep. It is close to the sea front, with easy short walking routes for connections with ferry and bus services, and now referred to as Britomart Interchange. This is the largest local authority infrastructure project in the country's history.

Source: Melvyn MAYLIN, and Sulojana SHANMUGANATHAN, 2004, New station brings trains back to Auckland's centre. *Civil Engineering [Proc. Institution of Civil Engineers]* 157(4), 164 - 171.

London Heathrow Airport Terminal 5 rail link tunnelling completed

London Heathrow Airport's Terminal Five will, when complete, be enormous, with the same passenger capacity (30 million passengers per annum) as the whole of Gatwick Airport. The building's five floors will have the floor area of about 50 football pitches. And there will be some 13.5 kilometres of associated bored tunnels, comprising:

Heathrow Express Extension tunnels - two 1.7 km twin-bore tunnels of 5.675m internal diameter;

Piccadilly Line Extension tunnels - two 1.9 km tunnels of 4.5m internal Diameter;

An airside road tunnel;

A peoplemover tunnel linking T5A and T5B (and ultimately T5C)

Two 130m service tunnels conveying cables and pipes under the A3044.

A stormwater outfall tunnel.

The two passenger railways will serve a joint station with three island platforms and six lines. Much of the railway tunnelling is completed, and work on tracklaying, signalling, and so forth is in progress.

Source: ANON, 2005, T5 tunnelling complete. *Modern Railways* 62(681), 37 - 38.

ROAD TUNNELS

Weston Hills road tunnel at Baldock, Hertfordshire

A new 240m cut-and-cover road tunnel is being constructed just outside Baldock. Work started in 2004 on a new by-pass, to the east and south of the town. This will be largely in cutting, and will include the new tunnel across a part of the Weston Hills, the cut-and-cover approach being preferred to a huge open cutting on environmental grounds. The work will call for the removal of 1.5m cubic metres of chalk, most of which will be retained within the bypass fencelines as embankments and noise-control bunds.

Source: David PARKER, 2005, Life begins at fifty: more than 50 years since it was conceived, a Hertfordshire bypass is at last taking shape. Dave Parker reports from Baldock. *New Civil Engineer*, 27 January 2005, 28 - 29.

Road tunnel collapse at Doncaster, Yorkshire

There are two cut-and-cover road tunnels under construction below the Frenchgate shopping centre (currently being refurbished and extended) in Doncaster. An entrance to the northbound tunnel collapsed in late April 2005, as a 25m precast concrete roof beam failed.

Source: ANON, 2005, Tunnel collapse probe begins. *New Civil Engineer*, 5 May 2005, page 11.

The Cardiff - Glan Conway road and its provisions for bats and otters

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Fifteen finalists have been chosen for a British architectural award (the fifth Prime Minister's Award for Better Public Building), including a tunnel and a new road with built-in provision for wildlife.

The Cardiff - Glan Conway road is partly made of recycled materials, and includes passages for otters, and a winter hibernation 'cave' for bats.

Source: Martin WAINWRIGHT, 2005, Motorway flyover in public building award shortlist. *The Guardian*, 16 June 2005, page 10.

The Fréjus road tunnel (France / Italy) to remain closed to traffic after fire kills two

It has been decided that the Fréjus road tunnel, linking France and Italy below the south-western end of the Alps, will remain closed to traffic indefinitely following a collision in which a truck carrying rubber tyres burst into flames. At least three other vehicles were engulfed in the blaze, and two Slovenian truck drivers in their early 20s died. The eight-mile tunnel carried 80% of the truck traffic between France and Italy. This will now be re-routed via the Mont Blanc road tunnel, which has been re-opened following a period of closure resulting from a tunnel fire in 1999 in which 39 people died.

[Work started in 2004 on driving a parallel tunnel bore for use only for emergency services and escape purposes, but presumably this had not been completed (it's a 12 kilometre tunnel) before the recent fire]

Source: ANON, 2005, Tunnel stays shut after blaze. *The Guardian*, 6 June 2005, page 18.

What about the Stonehenge road tunnel, Wiltshire?

A public inquiry into the road schemes for the immediate area of Stonehenge was completed early in 2004, with the Inspector's report expected in the Autumn. No such report has yet been published (*New Civil Engineer* reported in February 2005), and there is some suspicion that the Government has effectively shelved the project to remove the A303 from visibility by diverting it through a tunnel. There has been much argument and discussion concerning the merits or otherwise of a cheap short cut-and-cover tunnel (the making of which would inevitably jeopardise archaeological evidence at the disturbed ground surface), or a longer and more costly bored tunnel leaving the land surface immediately around Stonehenge undisturbed. And further argument about 'short' (2.1km) and 'long' (2.9km) bored tunnel options. Another proposal is to re-route the road entirely, through MoD land. Transport Secretary Alistair Darling, meanwhile, has downgraded the scheme from National to 'regional importance.'

The National Trust's Director-General, Fiona Reynolds, has in an open letter to Darling urged him to authorise the A393 tunnel project. She urges the view that the Stonehenge landscape is not of regional, but of national and international importance.

Source: ANON, 2005, National Trust demands Stonehenge tunnel go-ahead. *New Civil Engineer*, 3 February 2005, page 8.

Proposed Stonehenge road tunnel, Wiltshire, 'back to the drawing board'

The Inspector's report into his inquiry into the road tunnel proposals for Stonehenge has now been released, and favours a 1.3 mile (2.1 kilometre) tunnel to divert through road traffic from the monument. The National Trust had called for a much longer tunnel. Apart from the aesthetic arguments in favour of removing the road from the immediate area of Stonehenge, there has been some concern for the wider landscape setting (the standing stone circles are only the core of a much larger monument), and for the safety of the archaeological potential of the surrounding land. A long bored tunnel would safeguard the archaeological potential of the land surface above it. A short, shallow, cut-and-cover tunnel would obviously destroy a strip of land and its archaeology, so would necessitate a major rescue excavation before work could proceed.

Alarmed at the costs, either way, the Government has now called for 'all options' to be reviewed (all over again!) Meanwhile, the present setting and visitor centre at Stonehenge are widely recognised as a national (indeed international) disgrace.

Source: Maeve KENNEDY, 2005, Stonehenge road tunnel is stalled. *The Guardian*, 21 July 2005, page 7.

Tomei - Meishin Expressway No. 2 on Honshu Island, Japan

The Tomei - Meishin Expressway No. 2, currently under construction and running parallel with the existing Tomei - Meishin Expressway No. 1, is intended to link Kobe to Tokyo on Honshu Island, Japan. Construction commenced in 1993 and is not expected to be completed until 2043, as 20% of the route is to be in tunnels, and another 40% on bridges. Viewed as

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grossly extravagant and unnecessary by many Japanese, the project is at present mired in allegations of suspect construction contracts and a complex web of bid-rigging. The Times' report includes an interior view of one of the tunnels.

Source: Leo LEWIS, 2005, Japan faces £ 200bn bill for the long and winding road. *The Times*, 14 July 2005, page 52.

NEWS - SEWER AND DRAINAGE TUNNELS

Diversion of the Piddle in Dorset

The west Dorset village of Piddletrenthide, on the banks of the River Piddle, has suffered from time to time from flooding. Heavy rain can double the normal flow rate of three cubic metres per second, much to the consternation of 50 river-bank householders. Forecasts of future rainfall trends lead to the conclusion that a greater number of properties may suffer flood damage in future. Severe flooding in 1996 and 2001 has led to the formulation and execution of plans for a storm-water bypass tunnel sufficiently large (1.6m diameter) to take a once in 50 years excess flow.

The 520 metre culvert has been driven by pipe-jacking under open land to the south and west of the village. Storm water will be diverted from the River, as required, by a 12m long weir, and reach the start of the pipe-jacked culvert via a 102m long concrete box culvert with a 2.4m x 1.4m cross-section, laid cut-and-cover fashion.

Water at the culvert outfall will travel via a further 20m culvert and spill down a gabion wall to flow across a water-meadow back into the river.

Source: Andrew MYLIUS, 2005, No piddling matter. *New Civil Engineer*, 10 February 2005, 26 - 27.
of 30 March 2005. torm. *New Civil Engineer*, 10 February 2005, page 28.

All News Items Prepared By Paul W Sowan

Books

Ore dressing at Devon Great Consols 1844 - 1978 by R,J.Stewart.

£5.25 Available form Moore Books www.moorebooks.co.uk

At its peak in the later part of the 19th century Devon Great Consols was both the largest copper and arsenic producer in the world and was at the cutting edge of ore recovery technology under the auspices of Captain Issac Richards. In spite of its nineteenth century prosperity the mine ceased production in 1901 and was abandoned in 1903. Throughout the twentieth century the mine was worked on a much smaller scale for a number of minerals including copper, arsenic, tin and wolfram.

Ore dressing at Devon Great Consols examines the techniques and technology employed throughout the life of the mine. It is in the usual Tamar Mining
Press format i.e A4, card covers, taped & stapled spine. It runs to 28 pages with 13 b/w illustrations and 7 colour.

Yorkshire Miners, Brian Elliot , Softback 144 pp 246 x 174 *price*

£11.99 Available form Moore Books www.moorebooks,couk

The book is part of a series Britain in old photographs. The author has had access to private collections and NUM archives to bring this collection of 250 photographs together. Most are previously un published.
The book provides a fascinating glimpse of Yorkshires Mining Heritage and in particular the men , their families and the communities in which they lived.
Chapter headings, Around the Pit Top, Underground, Years of Struggle, Parades and Galas, work and play , and monuments and memorials

Mines of Devon - A K Hamilton Jenkin, Soft cover, size 246mm x 174mm, 160pp

Price £19.95 Available form Moore Books www.moorebooks,couk

The Mines of Devon 1974 is a sought after volume and the rare volume 2 type written , bound produced by a local council posthumously in 1981 are brought together in this volume. There have been few alterations to the original transcript and details contained within. Hamilton - Jenkin is seen as one of the Pioneers of modern mining historical research and although other studies have found additional information and details these books stood as the starting point for any research.

Books

I don't need to comment on the quality of writing or information contained within, What I will say is if you are interested in Mining In Devon and don't have the originals this is a must for your bookshelf.

Collieries of Somerset and Bristol - John Cornwell

£10.99 Available form Moore Books www.moorebooks,couk

I am pleased to advise that this book has been republished as with a soft cover price. The original was sold out very quickly I guess demand for this volume may be similar.

The book contains 85 photographs of previously unrecorded scenes of surface and underground taken at 13 pits post-nationalisation in 1947. The underground photos were taken by Nigel Booth between 1960 -1961. The collieries featured include, Bromley (near Pensford), Braysdown - Radstock, Camerton - Charmborough, Coal Pit Heath - Glos, Harry Stoke - Stoke Gifford, Kilmersdon - Radstock, New Rock / Mendip - Stratton on Foss, Norton Hill - Midsomer Norton, Marsh Lane Drift - Farrington Gurney, Old Mills - Paulton, Pensford, Writhlington - Radstock

The Enemy Within - the secret War against the Miners,Seumas Milne, 2004 (third revised edition), Verso, 439pp PB

£10.00 Available form Moore Books www.moorebooks,couk

Described as "the most important expose of contemporary political Britain" - John Pilger. The book exposes how the British Secret services were used to infiltrate the NUM to using phoney bank accounts, staged cash drops, forged documents, agents provocateurs and unrelenting surveillance. MI5 and police Special Branch set out to discredit Miners leaders, planted tales of corruption were seized upon by the media and politicians in what became a savage smear campaign.

This book provides an insight into the demise of Coal Mining and how politics got in the way of a once Great British Industry.

Frank Turner's V1, V2 and V3 booklets

Frank Turner publishes a number of A5 booklets of military interest, including the three on Hitler's terror weapons of which details are given below. They include detailed descriptions of V1 launch sites in France, the V2 sites at Eperlecques and Wizernes (La Coupole), and of the V3 'London gun' at Mimoyecques. These are £ 4 each from Frank R. Turner, Glendale House, Marling Cross, GRAVESEND, Kent DA12 5UE, who can also supply a complete list of his almost 40 titles.

TURNER, Frank R., 2003, The V1 flying bomb: a history and a guide to launching sites in France. Gravesend: Frank R. Turner: 36pp [ISBN 1-901132-29-3]

TURNER, Frank R., 2003, The V2 rocket: a history, with details of the hardened launch sites in France. Gravesend: Frank R. Turner: 40pp [ISBN 1-901132-26-9]

TURNER, Frank R., 2003, The V3: The London gun. Gravesend: Frank R. Turner: 36pp [ISBN 1-901132-24-2]

The railways of Great Britain. A historical Atlas

This very large two-volume work, retailing at £ 125, is an atlas showing almost all of the railways (whether currently operational or closed) in Great Britain, including the Isle of Man. The Channel Islands and the whole of Ireland are excluded. The lines (colour-coded to indicate operating companies) are printed on a background of Ordnance Survey one-inch to one-mile maps of 1971 vintage (this date being chosen as on many of the later 1:50,000 sheets disused railways are obscured by parts of the motorway and new roads network built over their routes.) The Atlas depicts all lines operated by companies for the public carriage of goods or passengers between 1807 and 31st December 1994 (nine months after 'privatisation day, 1 April that year.) Exclusively military or industrial lines are not shown. Light railways and London Transport's lines such as the Newcastle Metro are included. Details are correct as at 31 December 1994. The maps for Greater London are duplicated to show main line and LUL lines separately, for clarity. Central Carlisle and Glasgow are shown at double scale, for the same reason. Lines and stations are labelled with names (of junctions, tunnels, and other features as well as stations) and dates of opening (and closure where applicable.

COB, Michael H., 2005, The railways of Great Britain. A historical atlas at a scale of 1 mile to 1 inch. Volumes 1 - 2. Revised reprint. Ian Allan Publishing Ltd: (7) + 1 - 434pp; (1) + 429 - 646 (maps) + xvi + 31 index pages [ISBN 0-7110-3002-2; 0-7110-3003-0][Maps 429 - 434 are printed in both volumes]

Cayo Santa Maria

The idyllic Caribbean island of Cayo Santa Maria, one of the smaller islands in Jardines del Rey group, which lie off the northern coast of Cuba, connected to the mainland at Caibarien, in Villa Clara province, by a thirty mile stone-built causeway, is gradually opening up for tourism with four and five star hotels, gorgeous beaches and a lush jungle interior.

However, it was not always the paradise it appears today. In the late nineteen seventies, Fidel Castro, as a gesture of goodwill, deeded the island over to his soviet allies and 'flipped the finger' at the White House by proclaiming it as Russian territory. The population, mostly fishermen and subsistence farmers and their families were relocated to the mainland and engineering units of the GRU (Glavnoye Razvedyvatel Upravleniye), or Chief Intelligence Directorate of the Soviet General Staff, the military arm of the KGB, moved in and began to build a highly secret subterranean complex.

Working only under cover of darkness, the huge bunker gradually took shape beneath the sand and palm trees. American CIA spy planes monitored the island as a matter of routine, but intelligence analysis failed to detect any installations or heavy shipments of machinery or supplies, either by air or sea. Enhanced photographic examination showed only a few crumbling roads that seemed to lead only to the abandoned fishing settlements and farms – nothing ever appeared that indicated any threat to the United States.

The complex was built of grey reinforced concrete on several levels and contained air-conditioning and generator rooms; fuel and food stores; a hospital and mortuary; administration and communications centres; dormitory accommodation for the personnel and guards; kitchens; toilets etc. On the lowest level was a maintenance workshop; equipment storage rooms; an armoury and, more sinisterly, cells and interrogation rooms. The corridors and most rooms were the unpainted grey concrete, the exceptions being the senior soviet army officers' quarters; they had gloss painted walls and often supplied their own rich carpets and luxury furnishings.

A circular emergency exit shaft led from the lowest level, accessed at each intermediate level, to emerge through a steel hatch into a surface vehicle garage, measuring eighty feet by one hundred feet, some fifteen feet high with a roof of concrete slabs supported by heavy steel girders holding up the thirty foot earth mound which concealed it with wide electronically operated doors giving access; this all being enclosed within a high walled compound which had a guard house controlling the gates.

These were approached by a sandy sunken road hidden from above by the density of the tropical foliage meeting above it. The beaches had high-voltage electric fences and intruder-warning devices to dissuade any sea-borne interlopers.

Due to the run-down of the cold war and the pull-out of the Russians (or the booting out by the Cubans - read it how you will), the entire complex was stripped of all equipment, the entrances sealed, ventilation shafts trimmed off at ground level and capped and the whole thing graded over with soil and sand so location and access is lost today. Many of the exiled population returned, people from other islands and the mainland colonised much of the virgin jungle which was cleared for farming.

International development corporations have invested heavily in the past few years, hence the emergence of the luxurious hotel complexes on this beautiful island, which once had an entirely different character.

From L Marielito

Subterranea Britannica Day Conference

Saturday, October 15th sees the Day Conference head to a new venue – the University of Leicester in the heart of the East Midlands. With its motorway links and fast rail services, this venue is easy to get to from many parts of the country and has on site car parking. We will be in a fully raked, state of the art lecture theatre.

This year we have 5 excellent speakers covering a wide variety of topics. Terry Wiseman will be giving an interactive talk on the Royal Observer Corp 'Transition To War'. Andrew Smith will give us an overview of 'Subterranean New York City'. Graham Eyre-Morgan from Sandwell Metropolitan Borough Council will be presenting on the 'Mystery Smethwick Bunker' whilst John Smiles will give an illustrated talk on the cold war remnants he found whilst on holiday in the Caribbean.

The day will finish with author Alan Williamson talking about the Auxillary Units of World War II in East Yorkshire. The film will be the Discovery USA programme 'Attack On The Wires' which focuses on how AT&T implemented disaster recovery after the destruction of their main New York City telephone exchange on September 11th.

All this plus member contributions and the Annual General Meeting where members will have the opportunity to comment on the running and future of Sub Brit and vote for the election of the committee.

We always welcome member contributions so if you would like to make a brief presentation see me during the day – we have a dedicated slot at the end specifically for this.

Andrew Smith

Notes from a visit to Poland

Ton Breuls and Joep Orbons suggested a visit to see underground sites in Poland so, in 1999, off we went. At the time, my Poland file was a very thin one - a few newscuttings about the Wieliczka salt mines, and that was it! The Lonely Planet and Rough Guide volumes noted a few underground tourist attractions, and Joep had made arrangements to meet an academic from Warsaw during our first day, after which we would just follow our noses.

We agreed to an afternoon rendezvous at the railway station at Pulawy which is pronounced something like Poo-waa-vee. Joep and Ton went out by car, but I preferred to take an overnight train from Köln to Warsaw, a comfortable way to cross the not very scenic North German Plain whilst asleep in bed, which gave me a morning to explore Warsaw being taking a local train into the countryside. So, amongst other things, I took the lift to the public viewing gallery near the top of 'Stalin's unrefusable gift' to the City .. the monstrously tall Palac Kultury i Nauki. Natives tell you this offers the best views in the city, as it is the only place in the city from which it doesn't dominate the scene! Down closer to ground level there is a science museum, very reminiscent of the London Science Museum shortly after it reopened after World War II, with lots of model steam locomotives with wheels that go round when you turn the handle! There is also quite a good coal-mining section.

Our first day or two were spent at the attractive village Kazimierz Dolny, on the banks of the river Vistula, here providing very serene countryside views. This had been, in its time, an important crossing point on a main east-west route across Poland, and had the remains of a castle which had been erected to control it. The main attraction here was a very small underground limestone quarry nearby at Bochotnica (described in more detail in Bull. Subterranea Britannica 31, page 31 (2000.)

Chalk 'caves' in the south-east

We decided, next, to start in the south-east corner of Poland, near the Ukrainian frontier, where an extensive series of chalk 'caves' are operated as a tourist attraction in the small town Chelm (pronounced Hewm), about 60 km east of Lublin. Finding the entrance to the 'caves' was at first a puzzle. We parked in a small square, in the middle of which was a very obvious ventilation shaft head, so we were pretty close. In fact we went right round the town centre several times, each time being directed back to where we had started by helpful natives. It eventually dawned on us that, on closer inspection, the building we had passed several times and taken to be a cinema (well, it looked like a cinema!) was in fact the caves entrance. Business was slow, but a German-speaking guide was found for us (Joep and Ton translating into English for me), and we had a tour to ourselves.

The underground excavations in the chalk are below the town centre, and operated as a tourist attraction, with a substantial souvenir shop and ticket office at ulica Lubelska 55a, prominently advertised as CHELMSKIE PODZIEMIA KREDOWE (podziemia means underground, and kreda is chalk.) An English-language guidebook describes the system as having its origin in 16th century chalk mining, several independent systems on various levels having subsequently become interconnected. The tunnels were adapted for tourism in 1972, with about two kilometres publicly visitable. A plan of the system, reproduced on postcards sold at the souvenir shop, relates the visitable tunnels to the streets and town square above, and gives an impression of four or five small chalk mines with interconnecting tunnels.

It is an extensive system of chalk caves which were at first independent, and accessed via individual properties on the surface, as floor levels were constantly changing, and the linking tunnels seem 'new' compared with the rest. Judging by the sounds coming down a number of shafts en route, many of the surface properties were public houses, so perhaps many of the caves had been used as cellars. Whether they had originally been dug as mines for chalk for lime-burning, or as quarries for building-stone, we were not able to decide. My impression was that chalk mining was the more likely as quarrying would have left more obvious signs of extraction of large squared blocks.

Our decision to start in this corner of Poland was rewarded by finding on sale in the caves shop a splendidly colour-printed guidebook to underground tourist sites in Poland, with sections for natural caves, mines, and military and other objects. This was on sale in several different language editions, including English. We retired to one of the pubs already mentioned to plot a route for the rest of the week.

We reflected that it might be a good idea to learn a few key words of Polish, as our 'cinema' was in fact clearly labelled in very large letters 'chalk mine' (in Polish of course!)

This very helpful guide was not to be found at any of

Notes from a visit to Poland

the other underground tourist sites, nor had any of them every heard of it, although they were pleased to be featured. I have recommended it to other SB members planning to visit Poland, but they have all found it impossible to find copies, despite the ISBN and Warsaw publishing address. The details are - TWOREK, Jozef, 1997, Subterranean tourist routes in Poland. Warszawa: Publishing and Advertising Agency "Dino": 32 pp [ISBN 83-900751-7-2] Contact me for photocopies if you plan to go to Poland and can't get hold of a copy.

The scenery in this part of Poland is very reminiscent of the parts of nearby Ukraine that I had visited about three years before, and Ukrainian-language newspapers are on sale in the shops. A large chunk of pre-World War II western Ukraine had of course previously been a part of Poland, with Lvov as an important Polish city.

Town cellars at Opatów

Opatów, we found, was a sleepy little town, with a large empty town square. A formidable lady at the tourist office (who spoke no English, German, or Dutch) conveyed to us (non-Polish speakers) that if we came back an hour later she'd arrange an English-speaking guide, and a private underground tour. At least, we felt fairly sure that was what had been agreed, as we retired to a pub for lunch. The arrangements worked out as expected. However, our formidable lady insisted on coming around the tunnels with us, holding forth loudly in Polish, to such an expect that the English-speaking guide could hardly get a word in edgeways! Again, as at Chelm, differing floor levels gave an impression of a number of separate caves systems having been subsequently linked together, perhaps to create a tourist attraction? An odd feature here was that many of the 'caves' seemed to be under the main square, rather than below the properties around the four sides. Perhaps the square had once been covered in buildings? We were not able to be sure what sort of ground the caves had been dug in, as they seemed mostly to be brick-lined. Our knowledge of Polish was advanced by one more word at Opatów. A 'gate' in Polish is 'brama.' Our formidable lady kept shouting ever louder to help us to get the most from our visit, and was particularly keen that we should admire the Warsaw gate (Warszawa brama.)

The Krzemionki flint mines

Neither the limestone quarries nor the chalk caves nor the town cellars visited so far are likely to have been much heard of outside Poland. But our next site is internationally known, at least amongst students of flint-mining. Where England has Grimes Graves, Belgium has Spiennes, and the Netherlands has Rijkholt-St. Geertruid, Poland has its own very impressive Neolithic flint mines at Krzemionki, a little to the north of the town Ostrowiec Swietokrzyski. Krzemionki is not a village, just a site out in open country. Curiously, the flint here occurs in a chalky limestone of Jurassic rather than Upper Cretaceous age.

There is a good visitor reception centre, with a café and a bookstall. Each of the two underground tours has a well-appointed building above it, with well-laid-out displays of archaeological finds, geological sections, models, and the like. Spiral stairs lead down to a circular corridor around the perimeter of each site, from which (standing in comfort) you can look into the well-lit crawling-height flint mine galleries. It is much better presented than Grimes Graves in East Anglia (managed by English Heritage), or the famous Dutch flint-mining site at Ryckholt-St-Geertruid (and at Spiennes in Belgium there is no public access at all.) Our guide spoke excellent English, and was delighted to learn that Joep and his father had helped at excavations at British flint mines (Norfolk and Sussex), and lived close to the Dutch ones, and that we had visited the similarly famous mines at Spiennes, near Mons in Belgium.

There is an open-air-museum, being a replica Neolithic village, on the site, the whole being set within a nature reserve. I noted solomon's seal, lily-of-the-valley, and juniper amongst other typical chalk plants.

The Wieliczka salt mines

Our invaluable guide book, from Chelm, indicated a visitable salt mine at Bochnia, a little way east of Wieliczka and Kraków, so we called there, and were told we could have a guided tour in English the next day at 10 a.m. for a small additional charge, to which we agreed. We went on to Wieliczka, and joined the tourist hordes on the standard and famous salt mine tour. It is a spectacular series of huge interconnected underground chambers, but one sees and is told about statues carved in solid rock salt, and visiting celebrities, and all sorts of things other than salt mining. Parties of thirty or so are led underground every five minutes, with English, French, German, Dutch, Japanese etc - speaking guides. You have to go at the pace set by the guide, laugh at his silly jokes, and have no real opportunity to ask questions let alone poke and out and explore! You are whisked along to the underground gift shop (where the pace slackens!) before being pointed at the lifts back to the surface. Whilst deciding there was nothing much of interest to us in the underground gift shop we saw a not very prominent notice advertising an optional extension to the standard tour, and for a few zlotys more we found we had a huge underground technical geological and

Notes from a visit to Poland

mining museum to ourselves (and a silent guide or minder who seemed rather to resent our having spotted this optional extension to the visit!) which was exceptionally interesting and well worthwhile seeing, with much more on salt mining geology and technology, impressive displays of archaeological artefacts, archival and printed documents and so forth, and enormous underground wooden treadmills and donkey-whims for raising salt or water. We were underground at Wieliczka at least four hours altogether, and emerged well-satisfied, having escaped the tourist crowds. A comfortable room with three beds in a pensionat cost us £ 5 each for the night! And we had a superb meal (including a vegetarian option) at a quiet but pleasantly decorated restaurant with a charming and helpful waitress. Again, embarrassingly inexpensive.

The Bochnia salt mines

The following day started with our retracing our steps to Bochnia for our visit to the salt mine there. Actual mining (as at Wieliczka) ceased some years ago, but the Polish government continues to employ 290 miners to keep the uppermost six (of originally 16) working levels in good condition ... the mine is preserved as an important industrial archaeological monument. Another 30 staff are employed to run the tourist visits, although we were lucky (September is quieter than high summer) to escape the crowds. The mine had sought out a local teacher of English to be our guide, and he was very patient in answering all our questions. Three Poles were with us on the trip, and were equally eager to help us to learn all we wanted. We were allowed to go off the set route, and were underground for a considerably longer time than the standard tour duration. This visit was much more concerned with real mining than with rock-salt gnomes!
The English teacher told us that under communism, all Polish school-children had had to learn Russian, but now that Poland has joined NATO and (subsequently) the EU there is a desperate rush for almost everybody to learn English, and certainly large numbers of Poles were anxious to practice their English by helping us.
Thence we drove to Kraków, which is on a par with Praha or other crowded honeypot European cities. Whilst enjoying the sunshine and watching the world go by on a terrace in the main square we gave some thought to our next visit, which we'd hoped to make an underground tour in a coal mine near Katowice. However, the guide book said 'book in advance' which we tried, without success, by telephone. There was only incomprehensible Polish at the other end of the line. A Polish-speaker (who turned out to be an American employed as a deck officer on an icebreaker in the Antarctic!) did his best to help, and we telephoned again, but no tours were on offer the next day. We drove through a dramatic thunder-storm and spent the night at a hotel on a motorway near Katowice. Apart from the low charges (about half what might be expected in the UK) this hotel could have been beside any motorway anywhere! Very comfortable, and very bland ... with the exception of the horseradish (a much appreciated herb in Poland.)

World War Two German underground works

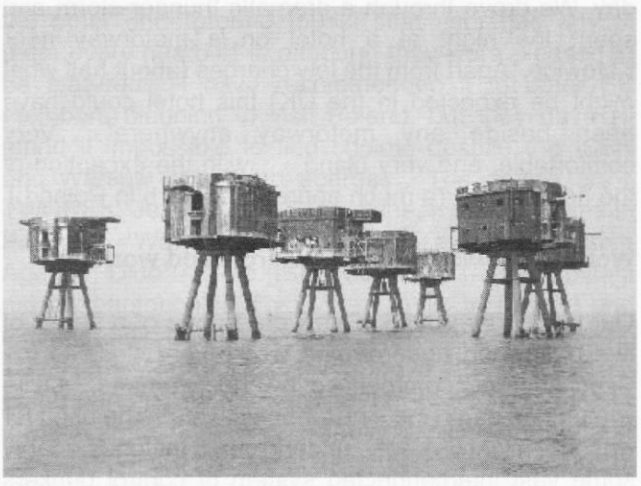
Our last underground visits were to one of a series of five unfinished underground works very close to the Czech border, commenced by the Germans. Quite what these dank and sinister holes were to be used for was not clear - partly underground factories, partly some vast interconnected system of control bunkers according to the literature and the guides. We were part of a large group of Poles here, and they became much more friendly when they discovered we were from Belgium, England, and the Netherlands and not from Germany (Ton and Joep had been using their German to elicit information from the guide.)
After an overnight stay in Luban, we crossed the border back into eastern Germany at Zgorelec / Görlitz, the now Polish and German halves of a town divided by the Oder-Neisse line after World War II. Then it was motorway all the way back across Germany to Maastricht. The most interesting point was the former East / West German frontier (now gaudy western-style filling stations and restaurants), where the machine-gun bunkers and floodlights and watch-towers survive to remind passers-by of a once-divided Germany.

Conclusions

Apart from a brief storm near Krakow we enjoyed warm sunny weather in September, and encountered no difficulties with the language, a great many people evidently being anxious to practice and improve their English. At several places English-speaking guides were found for us at a small charge (about £ 5) and in addition we had (other than at Wieliczka) most guided tours to ourselves, and were allowed to take as long as we wanted, ask all the questions we wanted, and at times depart altogether from the standard tour route. There are plenty of interesting sites open to the public, and plenty of non-public sites waiting to be found. Wieliczka is worth seeing, but very touristy. Don't miss the underground museum before going back up to the surface. And don't miss the much better salt mine visit down the road at Bochnia. Krzemnionki is highly recommended. Good local maps could usually be found at filling stations. Accommodation was easy to find and inexpensive. Treat the horseradish on the breakfast table with caution!

From Paul W Sowan

Visit Report - The Maunsell Sea Forts



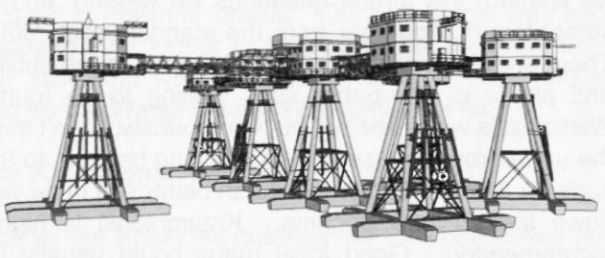
Shivering Sands Fort

On Saturday, 23rd July, 11 Subbrit members finally embarked on a trip to see the remains of the Maunsell Forts in the Thames estuary; the previous trips having been called off due to bad weather conditions.

We left Herne Bay at 09.30 in a fishing boat, Excel 2, accompanied by its owner and local historian Peter James our guide. Herne Bay harbour dries out at low tide so trips have to timed to go out and get back in a window of about two or three hours either side of high tide.

We went slowly out of the harbour passing the remains of the end of the pier which has been isolated about half a mile off shore since a fire in the 1950s.

Once out of the inshore area we accelerated rapidly to 14 knots and made our way to out first destination Knock John Fort which is about an hour and quarter north of Herne Bay.



Knock John Fort is a navy fort built in 1942 whose main purpose, we were told, was to extend radar cover out into the Thames Estuary. It was also equipped with two 3.7 inch A-A guns for defence. It consists of two 60 ft high concrete cylinders mounted on a sunken pontoon. A deck is mounted across the top of the two cylinders on which was mounted the two guns, the radar and the officer's accommodation. The men lived in windowless accommodation inside the cylinders.

There is no access now to the deck from a boat such as ours, the deck being about 30 feet above the water even at high tide. It was nevertheless interesting to circle round the structure which, apart for the lack of access, seemed in remarkably good condition after over 60 years at sea. We could make out Radio Essex 222 written on it; a reminder of the pirate radio days of the 1960s.

Our next port (fort?) of call was Shivering Sands Fort. This is an army fort and consisted of 7 smaller forts laid out similar to a land based AA battery. There are now only 6 forts at this site as one was knocked down by a passing ship.

The forts were all interconnected by walkways but these were demolished by the navy to stop people from landing. Still marked up on one of the forts was Radio City 200m. There were also some ropes connecting the forts which were the remains of rope suspension bridges installed by the pirate radio DJs to get between the forts.

Whilst there were some remains of ladders up to the upper landing stages access to any of these forts looked, at best, extremely perilous. We were told that even if you did manage to survive making your way to the under side of the fort the trap doors into the forts had been welded shut.

Finally it was onto Red Sands Fort which was similar to Shivering Sands except that it had all 7 of its forts extant.

We then made our way back to Herne Bay via the wind farm that is being constructed about two miles or so off shore. This consists of about 30 turbines of which less than half have been completed.

We arrived back at about 16.45 having had an excellent day out. Thanks to Sue Monsell for organising and then re-organising the trips and to Peter James our guide for the useful information he provided en route.

Bob Clary

It doesn't always go according to plan!

Since it's formation in 1972 Subterranea Britannica has always been a very active society organising visits to underground and cold war sites many of which are not open to the public on a regular basis. It has always been out policy to encourage members to conduct their own research and exploration which can later be published in Society journals or on our web site.

Sub Brit Member Neil Baldwin relaxes in the min digger during the first day

Since the end of the cold war, many bunkers that were previously 'out of bounds' have been abandoned and put to other uses, sealed or demolished.

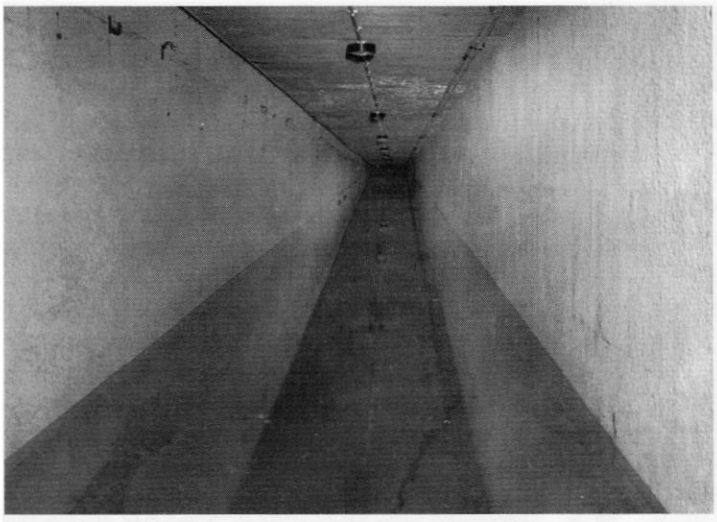
One of our most ambitious projects in recent years was the reopening of the former Rotor bunker at Fairlight in Sussex in 2002. This was masterminded by Sub Brit member Jason Blackiston who was able to persuade Hastings Borough Council that access could be gained with minimum surface disruption. The site lay within the Hastings Country Park and was designated an SSSI.

There was virtually nothing to be seen on the surface with not even a mound to give away the location of the bunker below. Jason was able to locate one corner of the guardhouse where a few bricks were still protruding from the grass. Using the original builder's surface survey and taking careful measurements on the ground, Jason calculated the position of the cable shaft which was located beneath a gorse bush. The bush was cut away (the only damage to the SSSI) and we started to dig. Eventually brickwork was reached which Jason recognised as a cable chamber adjacent to the cable shaft. By moving a few feet to one side we hit concrete and after a few hours with a Kango entry was made into the cable shaft. The bunker was surveyed, photographed and resealed with concrete the following day. Today the site of the excavation can no longer be identified.

Another success story came in 2004 when we turned our attention to RAF Wartling, another cold war Rotor Station is Sussex. Here we were presented with a different problem. The emergency escape shaft was still extant and clearly visible on farmland. There had always been access (with permission) to the upper level of the two storey bunker but for the last 30 years the lower floor was flooded. In 1987 when the bunker was first visited by Subterranea Britannica the water level in the lower corridor was over two feet in depth with over five feet of water in the lower level rooms where the wooden floorboards had been removed or rotted away. By 2004 the water level had risen to seven and a half feet above the level of the lower corridor which was now almost totally submerged.

In spring of 2004 the owner was approached by Sub Brit member Bob Jenner and it was agreed that an attempt should be made to pump the bunker dry. Sub Brit member John Smiles took over the organisation of the 'big pump'. The water was tested by the Environment Agency who declared it fit to pump directly on to the land. It was decided to wait until later in the year when the ground would hopefully be at its driest and a start date of 11th of August was set for the 'big pump'. By the time the pumps were turned off 12 days later some 2.75 million litres of water and been pumped onto the surrounding farm land leaving only a few inches in the bottom of the bunker. A well

It doesn't always go according to plan!



The flooded entrance at Crosslaw - the water can be seen reaching the roof.

subscribed open day was held for Sub Brit members and three days later the emergency exit door was welded shut and once again the bunker was allowed to flood.

These and several other success stories have been well publicised in our journals and on the web site but unfortunately things don't always go according to plan!

Also in 2004, Sub Brit member Keith Ward arranged for the Society to excavate the entrance to a large deep level public air raid shelter located on woodland on Epsom Golf Course. Armed with detailed plans of the shelter and a large scale ordnance survey map that clearly showed the entrance cutting we made an initial reccee of the site to determine what was required. It was soon clear that the cutting had been completely infilled with builders rubble and scrap metal, probably some time in the 1970's. We located what appeared to be the infilled side of the cutting and started digging. We soon reached concrete which stretched out over a wide area two feet under the soil. This could have been the roof of the shelter and a possible point of access. We drilled into the concrete but after two feet we hadn't got through and eventually we came to the conclusion that the concrete slab was probably too high up to be part of the bunker itself and was more than likely a blast cap some distance above the two entrance tunnels.

The only possible means of access was by excavating the infilled cutting to try and locate the original entrance which could be up to 12 feet below the present ground level. In order to do this in the shortest time with minimum disruption to the golf course, we decided to hire a mini digger. This was paid for by members of the Society who wanted to subscribe to the project. Those members who subscribed would get access to the shelter if and when we were able to get in. The golf club agreed to our proposed course of action and early one Saturday morning several weeks later we arrived on site with the digger and an eager band of helpers – we were all confident of success. However on this occasion failed in our mission. Despite moving many tons of soil, rubble and scrap metal, not to mention a few small trees over the next two days we were unable to locate the entrance tunnel and eventually late on Sunday afternoon the hole was partially backfilled to make the area safe and the project was abandoned.

We approached the golf club for permission to use a larger digger. Initially they seemed enthusiastic until it went to 'committee' for further discussion. At this time they decided that they didn't actually own the site (!) and they were unable to sanction any further excavation. Sadly an opportunity lost but not through lack of trying.

This summer also brought a disappointment. Sub Brit member Gavin Saxby located the owner of the Crosslaw rotor bunker on the east coast of Scotland just north of Berwick on Tweed. All surface buildings have long gone but the guardhouse has been tastefully converted into a family holiday home. The main stairwell has been carpeted and converted into one of the rooms of the house but access into the bunker was retained by passing through two new doors into the original entrance tunnel. The bunker was visited by a Sub Brit member in the mid 1990's and at that time everything was accessible although there was some water at the lowest level. The owner went into the bunker a year ago and although the water level had risen it was still possible to get along the main spinecorridor.

Unfortunately when the Sub Brit team arrived and opened the door it was soon apparent that the water level had risen considerable since the previous visit. Stepping through the doorway we were already in several inches of water and as the tunnel sloped downwards the water level could clearly be seen reaching the ceiling ahead of us.

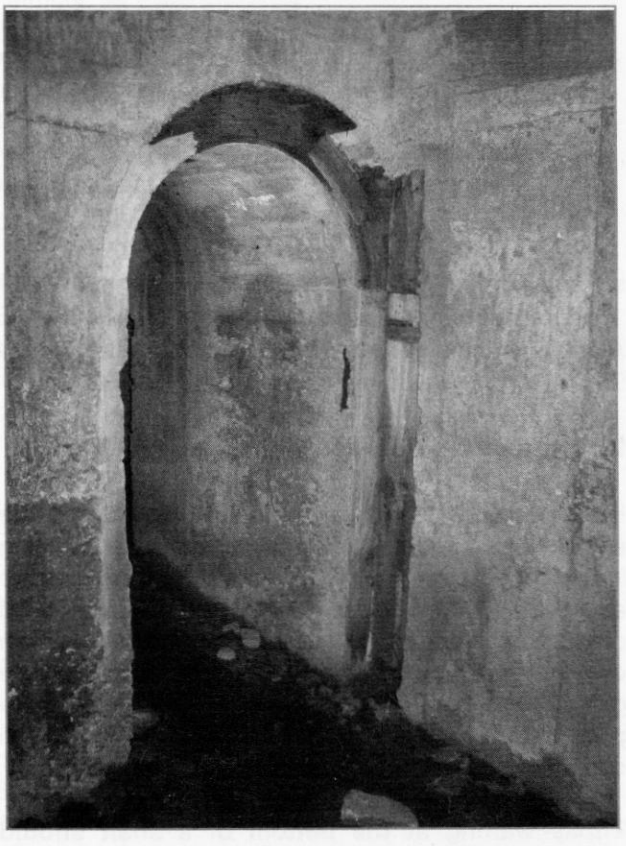
If the water level continues to rise, which it almost certainly will, it will soon seep though the wooden door and start to flood the carpeted stairwell of the holiday home.The owner was shocked by the sudden rise in the water level and is arranging to have the bunker pumped dry in the very near future after which an attempt will be made to locate the source of the water ingress and seal it. At this time Sub Brit members will be allowed back into the bunker to make a full photographic survey which will be published in a later edition of Subterranea.

From Nick Catford

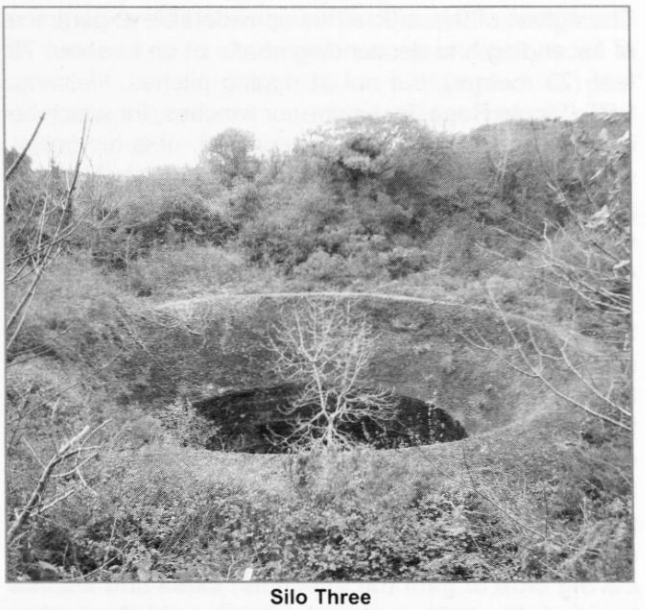
Cherbourg Silos

After reading about the silos at Cherbourg on this mail group a couple of months ago I decided to go and have a look for myself. As a result three subrit members, myself, Nick Catford and Sue Monsell caught the midnight ferry to Cherbourg on Sunday. The ferry arrived in the dark at 5.30 Monday morning and after waiting three hours for daylight we were on our way.

The site proved easy to find being clearly marked with an old sign saying "Terrain Militaire". It is now used for grazing horses and appears to have had no military activity for many years. The silos are contained within barbed wire fences and are very overgrown with brambles, gorse and saplings making it impossible to see them from outside the fencing and, because of the fencing and the vegetation, the original tracks shown on maps of the site are now no longer traceable. After exploring the four German gun emplacements on the cliffs we started our search for the silos. We found the first silo fairly easily on the left of the entrance track set about 15 feet below ground level. After cutting back the undergrowth to clear a path down to it we were soon standing on its rim looking into it. It is certainly a most impressive construction being about 40 feet deep and 50 feet diameter with a 6 foot circular hole through the bottom going into a lower chamber. Silo 2 was next, this proved to be more of a problem being completely covered with brambles and impossible to see in its entirety, but we did find its blocked entrance. Finally,



Door inside underground workings showing shuttering still in place.



Silo Three

the third silo was also easy to locate and a similar size to silo 1 but not easy to get up onto without a ladder which, of course, we didn't have with us. I tried to climb up some ivy but couldn't quite get there.

While exploring the site we had noticed the site plan in Philip Henshall's book "Hitler's V Weapons" had marked on it some underground workings accessed from a cutting outside the site about a quarter of a mile away. We felt we should investigate even though we expected them to be blocked off. Again a helpful sign identified the start of the cutting off a nearby lane and after a diversion to look at several air shafts coming out of the ground we located the entrance. Much to our surprise the entrance to the tunnel was open and shows no signs of having been bricked up. The tunnel, which was unlined, goes straight in for about 100 yards at which point there is a crossroads. Turning left we saw daylight and after a short walk we found ourselves under the bottom of the first silo looking up through the 6 foot hole I mentioned above. The whole of the construction looked unfinished with much of the shuttering still in place and many side chambers incomplete. Ventilation ducting was set into the walls at high level but there was no sign of any plant. The other tunnels off the crossroads also looked unfinished and only went a short distance before ending. The tunnel going straight on which is shown on the map to go to the third silo about 100 yards further on ends in a deep pool of water. Maybe it proceeds at a lower level and has been flooded, we couldn't tell.

We then had lunch looking out over the English Channel and spent the afternoon visiting some V1 ski sites before catching the evening ferry back to Portsmouth, arriving at 22.30 having had an excellent day out.

From Bob Clary

Health and safety notes - vertical ascents and descents

The author of this article has considerable experience of ascending and descending shafts of up to about 75 feet (23 metres), but not of rigging pitches, lifelining, SRT (Single Rope Technique) or winches, for which he is not adequately trained or equipped. It is his policy, which he recommends to others, to **depend on properly equipped and experienced and competent cavers to assist with caving ladders and ropes, pitch rigging, and lifelining**.

Shafts are negotiated by free-climbing (in the simplest shortest and safest shafts only), by using existing ladders or step-irons (where there is no doubt about their integrity), or by using wire caving ladders. Well-equipped, trained, and practised cavers may also use SRT (single rope technique) or other such methods, or powered winches, which are outside the scope of this article. **You should join a properly constituted caving club to gain the specialist skills and access to the right equipment and advice and information if you want to tackle any particularly ambitious shafts, not to mention the third party insurance cover such membership would include**.

The dangers

The most important rules for shafts concern the dangers posed by falling objects, rather than falling human beings. The top few metres of old stone-lined shafts are often through unstable ground which could run in. Bad air could also be a problem. **Remember that old shafts may have been used to dispose of a wide range of unpleasant objects and materials, from dead sheep to jagged iron and broken glass and unwanted chemicals. Carry a caver's Weils Disease alert card, which might save your life in the event of your having an accident (even an at first apparently slight cut or graze) and needing medical attention**.
The apparently solid floor you are standing on at the bottom of a shaft may in fact be a false floor of half-rotten timber or rusting iron hidden under some fallen soil. **Be aware that the shaft may continue down to water, or lower levels**.

These notes are for novices and others not familiar with standard caving practice, and not having SRT (single rope technique) or other specialised equipment, but they do include some advice on climbing wire caving ladders. Such persons should not be attempting exceptionally deep or difficult shafts. They assume that the party has where appropriate at least one person well versed in safe climbing practice, and possessed of appropriate life-lining skills and equipment (including an adequate caving rope!) **Any old rope, and even any old caving rope, will not do. Seek advice on rope selection and care (the strength and useful life of a rope is significantly and adversely affected by standing on it in gritty soil, for example**.)

The shaft top

Where there is an open or gated shaft, remember that the same underground site may have others nearby that may or may not be backfilled, securely capped (or not), or simply hidden under rotting timber, corrugated iron, or soil or vegetation.

Assess the safeness of the top of the shaft. Are there fixed objects such as trees or secure posts nearby to which safety lines can be attached? Does the ground at the top look secure, or liable to slip and run in? Does it shew signs of recent slips or falls? If there is any doubt about the ground stability at the top, lifelining is essential, and ascent and descent should be straight down the centre of the shaft, avoiding the sides at the top entirely. This will require the presence and guidance of fully competent cavers.

Even relatively shallow archaeological excavation trenches can be lethal. Alan Jones died accidentally in the course of archaeological excavation at Hayes with the West Kent Border Archaeological Group.

> A young archaeologist, Alan Christopher Jones, aged 19, of Hayes, Kent, died in hospital at Beckenham, Kent, last night after being trapped by a fall of earth in a trench at Spout Hill, Addington, Surrey. He and 15 other members of a Bromley archaeological club were working in a trench when it subsided

[ANON, 1967, Archaeologist dies after trench fall, *The Times*, 30th May 196; J.K. HORNE, 1967. Obituary: Alan Christopher Jones, *Kent Archaeological Review* 9, page 2]

Looking up or down shafts

If you want to look or photograph down a shaft, the safest thing is to do this when there is nobody climbing it or waiting at the bottom. If you are less than secure at the top, arrange to be belayed to a nearby fixed object, in case you slip. **If you really want to watch or photograph somebody climbing down, take great care to see that there is absolutely no possibility of any object such as a hand-held torch or a helmet without a chinstrap falling down**.

Those waiting at the bottom of a shaft should remain under cover to one side. And on no

Health and safety notes - vertical ascents and descents

account should anybody look or photograph up a shaft unless quite satisfied there is nobody climbing, and the top is clear. Even small stones and clods of mud falling from a climber's boots will do your eyes or your camera lens no good at all.

Preparing the shaft top

Any loose items (including bricks, stones, and tools) that could be kicked or dropped down should be kept well clear of the shaft top. And any items required underground should be lowered down in a bag on a rope before or after the party descends.

Climbing

Narrow shafts, where you feel relatively enclosed and can lean against the opposite wall for a rest, and it is harder to see the bottom, are psychologically much easier for most people than very wide ones. You may not have a good head for heights, but my experience is that standing above a seventy foot drop is far less worrying in the dark than it would be up a tower in daylight!

It is unsafe to have more than one person at a time climbing in the shaft. And all those climbing must wear helmets, as even small falling objects can, at best, be painful. **Proper caving helmets should be worn - not second-hand ones from a building site**. In the event of two or more people climbing, which is advised against, none of them should be carrying loose objects or unsecured helmets (lacking chinstraps or lamp cables) which could be dropped. **Torches carried in pockets are an accident waiting to happen**.

At all times you should have three-point-contact. Both feet and one hand securely on the ladder. Or, if stepping up or down, one foot secure and two hands. Your feet should be securely on the rungs, your weight being on your instep. If only your toes are on the rungs, you could easily slip off.

Use your thigh muscles to lift your weight. It is a common and dangerous mistake to reach up too high and try to use your arm muscles to pull yourself up. Your arms have far less strength than your legs.

Know your limits. Don't even think about climbing a shaft until you know its height or depth. If your safe limit for confident vertical climbing is, say, forty feet (12 metres), you will probably find the last twenty feet of a 60 feet (18 metres) exhausting and scary, especially if it is awkward to scramble off the ladder safely at the top.

It is good practice to use the standard caving calls to communicate between top and bottom of a shaft. The standard calls are designed to give unambiguous signals, in the caving context often against a noisy background of falling water. In the context of free-climbing a short fixed ladder, the person at the top should call down 'shaft clear / climb when ready' and the person at the bottom should call 'climbing' before starting up.

When being lifelined, it is essential that the person climbing does not start to do so until the lifeliner gives the signal that he is ready. Having attached himself securely to the lifeline (bowline or karabiner / belt) he calls up 'take up slack.' When the lifeline is taut he calls 'that's me.' The lifeliner then calls 'climb when ready.' You then call 'climbing' and up you go. If you do slip off the ladder, the lifeliner will arrest your fall almost immediately, and you will not fall far. It will be painful and scary for you, and your lifeliner may have rope-burns if not wearing proper gloves. But you will not have fallen to the bottom, nor will you have pulled your lifeliner down the hole on top of you, as she or he will be belayed to a nearby tree or rock or gatepost!

Where lifelining is being done, it is best if all concerned have a proper load-bearing caving belt with a secure fastening, to which the lifeline can be clipped with a karabiner. If using the traditional bowline instead, be sure it is correctly tied: the wrong sort of knot could, in the event of you falling, slip and try to cut you in two! This would, at least, be exceptionally painful, and is more than likely to cause serious injury or death. If you'll be doing a fair bit of shaft climbing, get the right sort of belt and karabiner and be sure you have a competent lifeliner in the party.

Probably the safest shafts to negotiate are more or less modern lined shafts (often lined with concrete rings) of small diameter and having modern or at least sound fixed ladders or steps, such as may be found as escape shafts from military bunkers, for example. In narrow shafts, you can lean back on the opposite side of the shaft to have a rest from time to time if needs be; but do not forget that at all times you should have 'three point contact' with two feet and one hand, or two hands and one foot, securely on the ladder. However, the soundness of any fixed steps or ladders should not be assumed, and certainly if a new site is being explored it would be more than sensible for at least the first person down to be lifelined, and to assess their condition. **Bear in mind also that although the main climb may be straightforward, it may be difficult to get on or off the top of the ladder (probably the most dangerous part of the exercise), or to get past any narrow points lower down, or to negotiate other hazards such as missing rungs, changes of**

Health and safety notes - vertical ascents and descents

shaft or ladder orientation and so forth. If at all in doubt, opt for lifelining, making sure that whoever is rigging and handling the lifeline at the top is competent and herself or himself properly secured, and ready if the need arises to arrest the sudden accidental descent of the person climbing. Half-decent lifeliners will have practised with suddenly-dropped bags of sand or the like!

In many shafts with step-irons it will be observed that some are bent or broken or even missing. Remember that this is a continuing process. The next one to bend or break without warning might be the one taking your weight at the time!

Remember that if climbing up you are able to inspect each rung in turn before trusting your life to it. When climbing down, on the other hand, it may be difficult if not impossible to see the next rung down, and you will have to feel for it with your foot, and assess its reliability before letting it take your weight. **Be prepared for the possibility of a weak or missing rung, or a sudden difference in direction or vertical spacing. Ensure that anybody following is warned of any such snags**.

If something falls or is dropped down a shaft, at least **shout BELOW as loudly and immediately as possible**. If in the shaft, on no account look up! Contract yourself as close to the ladder as you can to give the smallest possible impact area, protected as much as possible by your helmet. Grasp the ladder with both hands very securely. With luck the falling object (usually a hand-held torch falling from somebody's pocket) will miss you. With luck, at worst, you might get a bruised shoulder or fingers. **Any such loose object shouldn't have been in the shaft in the first place! Nor should there have been anybody above you in the shaft or holding such an object over the top**.

Caving ladders

Wire caving ladders have steel vertical wires and strong metal tube rungs either ten inches or twelve inches apart. They generally come in short lengths, and are clipped together using ingenious C-clips, to make longer lengths as required. A ten-inch ladder clipped to a twelve-inch ladder can cause consternation to those climbing if they are not aware in advance of this.

Do not wear walking boots which have hooks for the laces when climbing wire ladders. The hooks very easily catch on the side-wires, causing alarm and time-wasting if nothing else.

If such a ladder runs over bare rock or concrete at the top of the pitch, it may be that it is impossible to get your fingers around the rungs or side wires. Another problem, if this is the case, is that you could climb up the wrong side of the ladder! Climbing round to the right side can be done, but is not advised, and it is better to start correctly in the first place! Or go back to the bottom to have a rest and try again later. Really the ladder should be re-rigged to be hanging free and vertical and further out into the shaft. You should certainly be lifelined in such a tricky situation. Once your feet have located and are securely (not just toes) on the rungs you can start climbing with confidence. Another difficulty is climbing before making sure the lifeline has not gone through the ladder! It is safer for the lifeliner at the top to look down the shaft to make sure such problems will not occur, than for the climber at the bottom to look up.

Climbing technique

Its easier than it looks! The most important thing is to keep your whole body or at least your centre of gravity as close to the ladder as you can. The ladder should stay pretty vertical. If your rear end is hanging out in one direction, and your feet way off in the other direction, you are making life difficult for yourself! Don't reach up too high. And hold the rungs from behind (this will help to keep your body and centre of gravity close to the ladder.) Let your leg muscles do all the work. Splay your legs out so that your knees go either side of the uprights. This again will help keep the alignment right. Each rung is not wide enough to take two feet side by side. The best way up or down is actually to put your toe through from the front, and your heel through from the back, on alternate rungs. This again helps to keep you upright. Make sure each time that your instep engages with the rung.

A constricted shaft can make it very difficult for the long-legged to find the space to bend their legs enough to make each step, especially if the rung spacing is twelve inches. But makes it easier to stay vertical! Good climbing technique is more important in a wide shaft, where there is more scope for you to swing about and go off-balance. At all times, keep up to the ladder in a close embrace and all will be well!

On reaching the bottom, detach yourself from the lifeline, call 'rope free', and step under cover away from the shaft (having first had a look at the nature of the spot you propose to stand on!)

Bad air

By far the most significant bad air hazard in shafts is

Health and safety notes - vertical ascents and descents

probably carbon dioxide. This has a specific gravity of 1.53 (relative to air at 1.00) so it is likely to accumulate like water in deep shafts. At concentrations above 0.5% by volume it is considered a significant hazard, and above 5% is an immediate and serious danger to health. Exhaled air contains 4% carbon dioxide, which is of course immediately diluted on being breathed out. Normal air contains 0.03% carbon dioxide.

The dangers, even for a shallow trench, are illustrated by the case of Christopher Noonan:

> A man died yesterday six days after being overcome by fumes while trying to rescue his father from a trench. Christopher Noonan, aged 21, of Leeds, had been in intensive care at Barnsley district general hospital since the incident last Saturday. He and his father, Stephen, 49, were installing a sewer at Hoyland, near Barnsley, when Stephen was overcome by gas - believed to be methane - in a deep trench. He recovered in hospital.

[ANON, 1988, Son dies after rescue bid. *The Guardian*, 7th November 1998]

Miners and well-sinkers who made a living sinking deep shafts used various means of dealing with accumulated carbon dioxide, amongst which was pouring quantities of limewater down. Limewater (a solution of slaked lime or calcium hydroxide in water) reacts with carbon dioxide, forming precipitated chalk as the end-product.

Hydrogen sulphide (specific gravity 1.18) is also occasionally encountered in shafts, especially through clays or shales or other materials (including some metallic ores) containing significant quantities of sulphur.

Methane (specific gravity 0.56) is less likely to be a problem, as being considerably less dense that air it tends to accumulate under mine ceilings, and escape up shafts rather than lie in a pool at the bottom.

Light smoke or a candle flame can be used to detect air movement into or out of a shaft top. Stagnant air, with no movement, is a warning sign that carbon dioxide may be a problem. Lowering a lighted candle in a jam jar on a string can be used, if you have a long enough bit of string. If the candle goes out before it reaches the bottom, it may indicate carbon dioxide, (or perhaps the candle has just fallen over!)

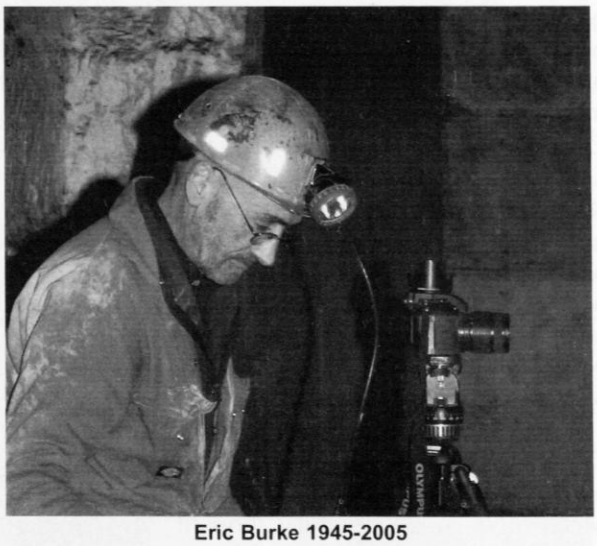
Consult the article 'Health and Safety Notes - Underground Air Quality' in *Subterranea* 7 (2005), pages 35 - 37 for further details and advice on bad air underground.)

From Paul W. SOWAN

Eric Burke 1945-2005

During the weekend of 13/14th August 2005, Eric Burke sadly collapsed and died whilst doing what he loved, underground exploration and photography. He had just returned to the surface from a trip round an old mine when he complained of feeling ill. All those who knew him are devastated by this news; the world has lost one of its great characters.

Eric had worked in many mines and always had a story to tell about the various people he had met and things he had done. His enthusiasm for exploring old mine workings was amazing and you could always be guaranteed of a good day out when exploring with him. What he really excelled at was underground photography. Many a time I have helped carry bags of camera kit into Box mines for him to take a few pictures and then help take all the kit out again. When you saw the finished picture, the physical effort was worth it. Perfectly lit and composed. How many people do you know who use 10 Metz flashguns to light one scene?. Eric was also incredibly knowledgeable on just about anything else you could think of. If you had a question, he would more than likely have the answer. Sitting in the Quarryman Arms chatting with him was always a pleasure and that is the one thing I will miss the most.



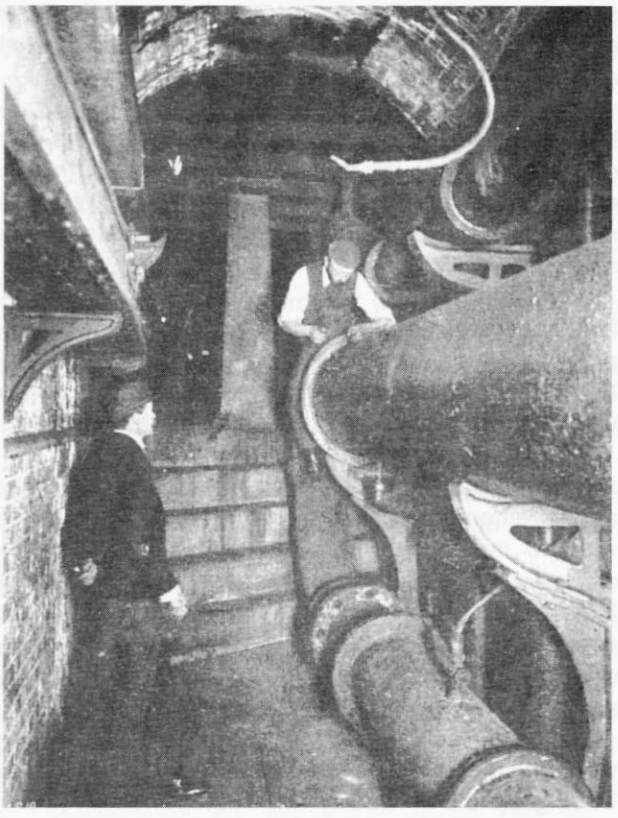
Eric Burke 1945-2005

I last saw him 4 weeks ago in the Lake District. He was as excited as ever to be going to look at yet another disused mine.

RIP Eric, you will be missed greatly by all who knew you.

Dom Jackson

Underground London – Reproduced from Strand Magazine – August 1898

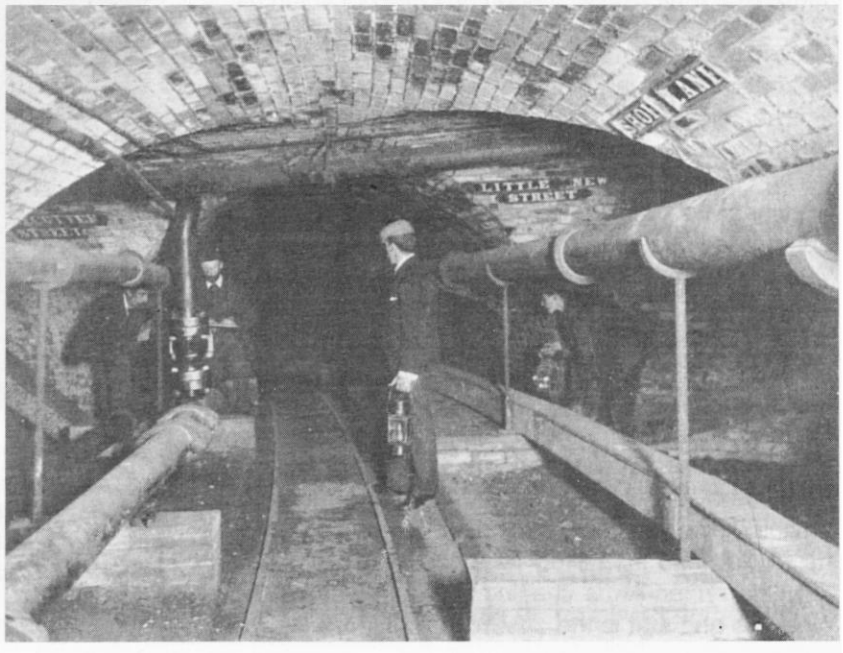


It is a time-honoured saying that if you want to know any thing about this great Metropolis of ours, you must not go to a Londoner in search of information. This is no doubt a trite remark, but the more one goes about, and the longer one lives, the more apparent its truth becomes. The foreigner intelligent or otherwise; who comes to London is very properly inquisitive; he questions, he inquires, he seeks for all that is curious or interesting with the natural consequence that, after a few weeks' residence he can often give points to the man who has lived in the 'heart of the Empire' all his life. The average Londoner on the contrary, is apt to take things very much more for granted. He knows that, on the whole, matters affecting his safety and his health are well managed and such being the case, he does not bother his head much about the why and the wherefore.

The vast organization, the capable administration, the host of details which have to be carefully thought out and rigorously applied, all these things are overlooked by the majority of people. The end is good; why bother about the means? Thus the average Londoner and not least the traveled Londoner, while he waxes enthusiastic over the wonders he has seen abroad - tells us about the admirable municipal arrangements which prevail in New York, and describes with animation the wonderful catacombs of Paris and Rome remains in total ignorance of the fact that here, in our great city, he might feast his eyes upon wonders no less remarkable did he but know of their existence. But it is useless to dilate in this vein; the Londoner will not be persuaded to go and see the wonders which lie at his very door. Only through the medium of the ever inquisitive journalist, always prying about in the dark places of the earth, does he sometimes learn about and admire these native wonders of the existence of which he has not hitherto dreamed.

I am bound to admit, as far as the nether world of the city was concerned, until a short time back I was not much better informed than many of my fellows. It is true that I knew there were such places as subways and sewers; but that was about all. I had hardly the faintest conception of what they were like and probably should have continued to remain in ignorance had it not been for a visit I paid them a few months back.

Quite by accident I came across the 'Report of the Improvement Committee of proceedings in connection with the Holborn Valley Improvement' which was issued twenty five years ago and randomly turning over its pages I was struck by the various references and diagrams in connection with the subways. The thing took my fancy; I discovered how ignorant I was of the underground arrangements that so greatly added to the comfort an safety of those sojourning within the 'one square mile' and I determined, with as little delay as possible, to make good the defect in my education.



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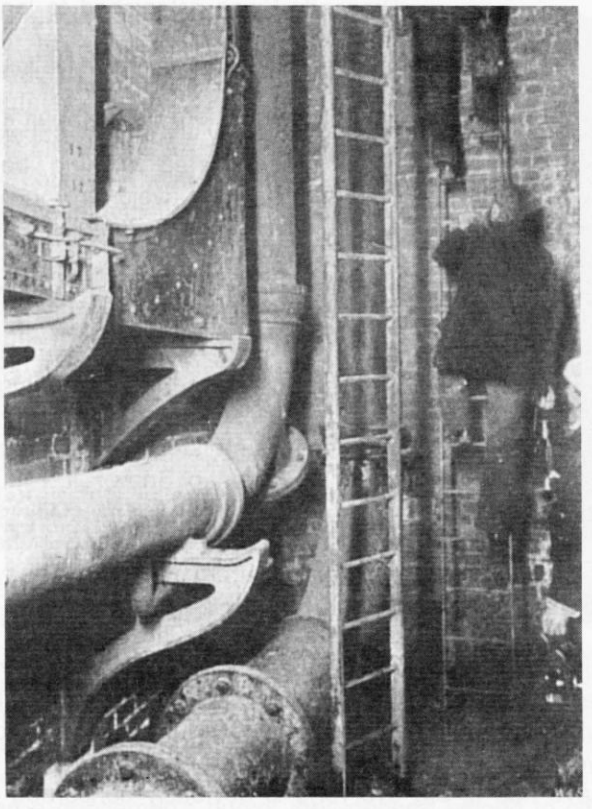


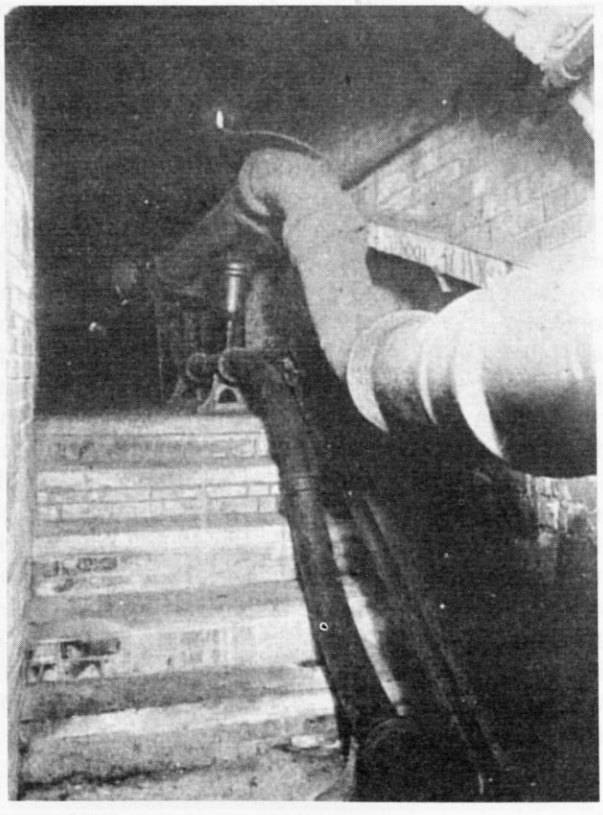
So I applied to the City Commissioners of Sewers for the necessary authority and it was willingly granted. The chairman, Mr. H G Smallman, entered enthusiastically into the matter, remarking that if the thing was going to be done at all, it should be done thoroughly. Remember this was the first time it had been proposed to write an illustrated article on the subject. The Chairman was rather dubious as to whether we would be able to get any satisfactory photographs of the sewers; but at all events he expressed his
willingness to do all he could to help us. So that we started our task under the best of auspices.

So one September afternoon we assembled outside the large iron gate beneath Holborn Viaduct - that gate which most people have noticed but the purpose for which it is used known to very few. Beside the Chairman, there was Captain Robert Gresley Hall D.I. the Chairman of the Streets Committee, Mr. D G Ross the City Engineer and Mr. Montague Bates the Chief Clerk to The Commissioners who, according to Mr. Smallman, is virtually the 'Permanent Chairman', the photographer with his assistant and the writer, brought our little party up to eight all told.

When the gate opened at our summons, Mr. W J Liberty, the City Inspector of Subways and under the engineer, the head of all practical matters appertaining to them was waiting to show us over his territory. The iron gate, through which the sunlight was streaming, closed with a clang and walking up two or three stairs we set out along one of the thoroughfares of the underground city. In the first instances, I experienced a feeling of disappointment; the reality was so different from what I expected. My idea had been that the subway would prove a damp sort of place, smelling of the earth, dark and with an atmosphere resembling that of a charnel-house. What did I see? A long, clean and well garnished looking passage, dimly illuminated by gas-jets which by the way were especially provided for our visit and having an atmosphere almost as healthy as that we had just left.

The feeling of disappointment soon gave way to one of admiration when we walked along the subway and the uses of the various pipes which ran along one side were pointed out to me. They include the mains of the gas, New River, hydraulic power and electric light companies, also the pneumatic tubes and hundreds of wires belonging to the GPO and the arrangements whereby the service mains are connected to the various houses show that simplicity which constitutes the high water mark of mechanical ingenuity. The usual time for making the connection is half an hour and in case of non payments of rates, a house can be cut off from its gas, water, electric light or power supply in a few minutes and this moreover, without the unfortunate tenant or the general public knowing anything about it.

I was rather amused to notice that the names of the various streets under which we were passing were



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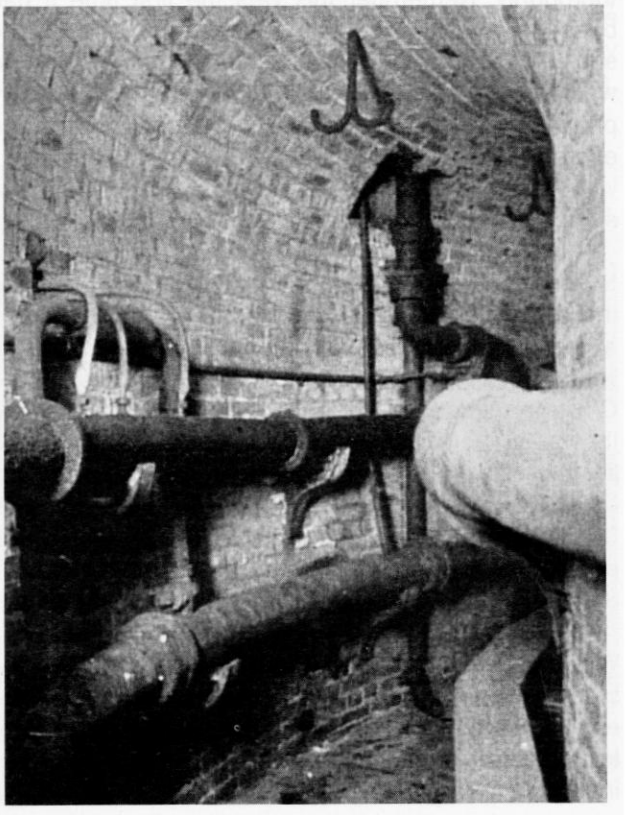
posted along the walls, as were also the numbers of the houses served by the mains, thus in case of emergency or fire all that has to be done is cut off the service at the particular branch where the mischief has occurred. As we went along, the Superintendent explained to me the exceedingly ingenious manner in which difficulties incidental to the construction of the subways had been surmounted and also pointed out how they were ventilated and generally kept sweet and clean. But this is not a technical article; I need not bother the reader with such details, interesting as they are to those with knowledge of underground engineering. Perhaps the most interesting subway of them all is the length on the southern side of Holborn, between Farringdon Street and Shoe Lane which is lighted by gratings filled with glass lenses, placed at intervals of 40 feet.

These render it sufficiently light by day for the purposes of inspection and work. The only daylight which gets into the others comes through the ventilation gratings in the footway and this has to be supplemented by artificial light. It might be thought, in view of the possibility of leakage from the gas mains, that working in the subways might be dangerous. The idea certainly struck me and I enquired of the Superintendent whether it was safe to smoke. His answer quickly reassured me; "every morning before any work is done; a most complete inspection is made." Armed with 'Daveys' the Superintendent and some of his men make a complete tour of the subways testing doubtful looking places, if anything wrong is discovered, it is speedily put right. "Be sure an extra inspection is made before the arrival of any distinguished visitors."

Presently I was astonished to learn that we actually stood over the London Chatham & Dover Railway. There we were, after painfully making our way through a subway which necessitated walking bent double in order to avoid striking our heads against the girders directly above Snow Hill Station. Yes, there is no doubt about it, as we wait we can distinctly hear a train come in and the porters shout out its destination. It seems exceedingly close, but closer still, above us; we can hear the footsteps of the people on the pavement of Snow Hill. This is rather uncanny and especially so when one learns that only 6 inches separate us from the street above and only a bare quarter of an inch of iron girder (for we are literally in a girder) prevent us from falling some 40 feet onto the railway metals. It is a novel experience (especially when the train is moving below and the spot in which we stand is positively vibrating!) and we are glad to have had it, but everyone is obviously concerned in trying not to allow his sigh of relief to become too apparent when we resume our journey.

If anyone looks pale, it must, of course, be attributed to the cramped position in which we have been standing!



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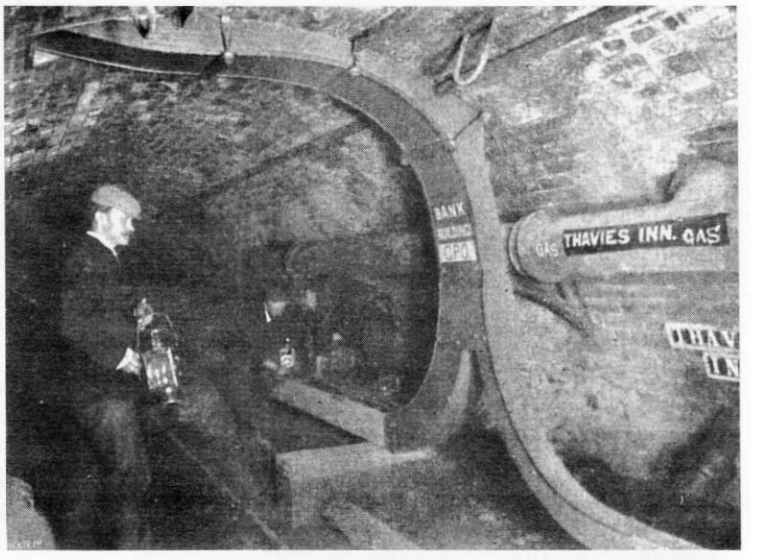
Shortly afterwards, we arrived at a spot which we were informed was immediately under the Prince Consort's statue at Holborn Circus. Coming back to the Superintendent's office I was shown a great number of coins nailed to the counter. These, I was told, came through the gratings placed at intervals for ventilating purposes. It appears that gentlemen who make a business of passing spurious coin sometimes find it necessary to get rid of their 'stock-in-trade' with the utmost dispatch; they drop the coins through the gratings under the impression that they will fall into the sewers and be eventually lost. Alas for the guilty one's hopes, the coins are found shining on the clean stone floor of the subway and go to swell the stock in the Superintendent's office.

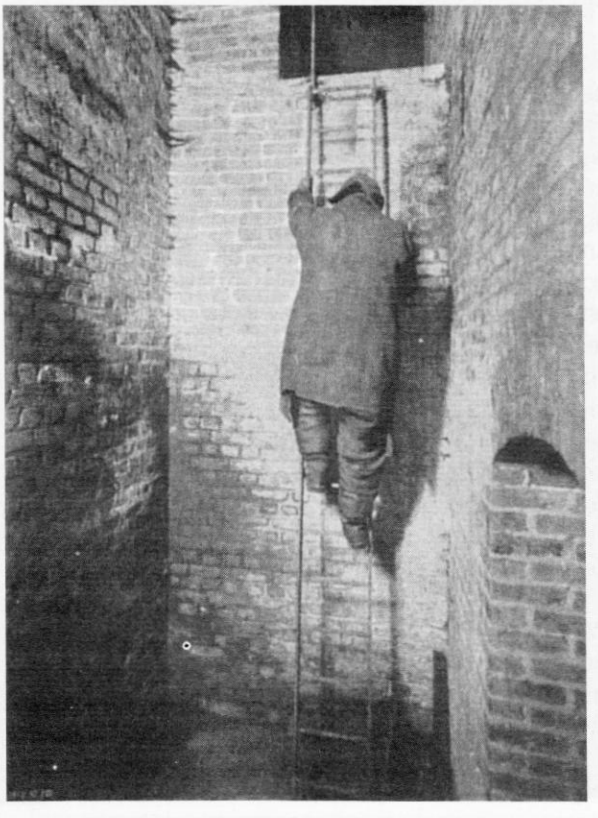


I asked him weather other articles were ever found. He replied "yes, we get plenty of empty purses. This is what the light fingered gentry do; they take them from the pockets of ladies and after carefully emptying them, drop them down the shafts. We find most of these in the dark days of winter and chiefly in the neighbourhood of crowded Smithfield. I seldom find a gentleman's purse; they general belong to city work-girls. The professional thieves know that when the girls draw their scanty wages on a Saturday they generally go to the great markets at Smithfield to make their little purchases and ply their nefarious trade accordingly."

Another interesting object in the Superintendent's little room is the 'visitors' book', In it the names of foreign visitors predominate. During the last year or so, scientific men,
engineers and sanitarians from Brazil, Malta, San Francisco, Finland, Santiago, Cologne,
Copenhagen, Sydney and in fact, almost every great city have visited the subways. In nearly every instance the visitor has written a few words expressing his surprise and admiration at what he has seen.

I could have stayed a long time chatting to the Superintendent but the shadows were already beginning to draw in and it was time for us to start on the second half of our journey. First he took me to the subway sewers which lie under Holborn Viaduct; these sewers are quite unique in their way. As nearly as possible they follow the natural slope of the ground as it descended originally from the hills to the level of Farringdon Street and consequently between the underside of the subways and the sewer is a large space and the effect when looking up from the latter is very striking. Standing in the sewer (by the way one is able to traverse these sewers dry-shod a platform running along one side) one seems to be in a lofty vault. It is; of course, pitch dark, for even the glimmer of light coming through gratings in the roadway which relive the murkiness of the ordinary sewers is absent here.

The space under the road in Farringdon Street is utilised for business purposes, large cellars having been constructed, with which entry can easily be made from the houses in the vicinity. These sewers are ventilated by square openings and shafts which drain the houses on the viaduct. Very great care an ingenuity has been exercised in the construction of these sewers



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and also in the disposal of gas, water and telegraph pipes in the subways; in fact, access to everything is so easy that it is thought that only the most exceptional circumstances will it ever be necessary to open up the roadway and thus cause a hindrance to traffic and stoppage of business.

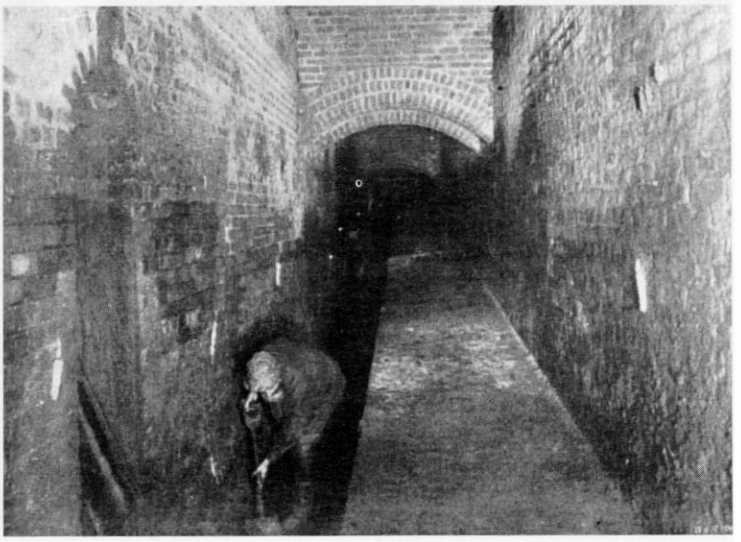
Before going down into the ordinary sewers it was necessary for us to equip ourselves.
First off came our boots and thick woolen stockings went over our socks and trousers and over those hung huge waterproof boots reaching to the thighs. The upper part of the body was covered with a rough blue smock, very similar to those worn by coastguardsmen. In fact there was something altogether nautical about the whole rig-out, the resemblance being heightened by the oil skin sou'westers we wore on our heads. We were also provided with rough gloves as we had to seize hold of things not very pleasant to the touch. Curious looking objects; we were fully dressed although in one or two cases which need not be particularized, the effect was decidedly becoming.

When we were all ready, we sallied out into Farringdon Street. About 100 yards from the viaduct is one of the familiar iron plates let into the pavement and this was our objective. Quite a crowd assembled to witness our decent; so large indeed that the kindly offices of two constables had to be requisitioned to enable us to get through. The large crowd could only guess at the reason for our decent; in spite of the fact that we were all smoking cigars, it never seemed to occur to the spectators that we were not the ordinary sewer men.

Most of the bystanders thought something was wrong; this opinion rapidly gained ground and in a few seconds it was freely whispered around that we were a rescue party going to succor some poor fellow who had been overpowered by the noxious fumes down below. I am afraid, judging by the ginger manner in which we went down the shaft, that we should not have been much good had any great difficulties been encountered. It was a primitive sort of ladder we had to go down, merely consisting of iron rings driven into the wall at intervals and in our cumbersome and unaccustomed attire it was not a very comfortable job.

However we got down without any casualties and arrived at the bottom where we found one of the sewer men waiting for us. He provided us each with a wooden sconce holding a candle and having been given this we went along a short sloping passage at the end of which stood another guide who assisted us to step down into the sewer itself. Down each one of us stepped into about a foot of swiftly flowing water; the Superintendent of the sewers together with some of his men placed himself at our head and in single file we commenced our novel march.

I looked around me curiously. Down here there was a distinct contrast with the clean and cheerful looking subways. Not, however, that there was anything particularly offensive about the sewers. The air, though close and hot, was not offensive and there was little or no odor in the large main. But from my position in the rear of our party I could not help but be struck by the weird picturesqueness of the scene. The pitchy



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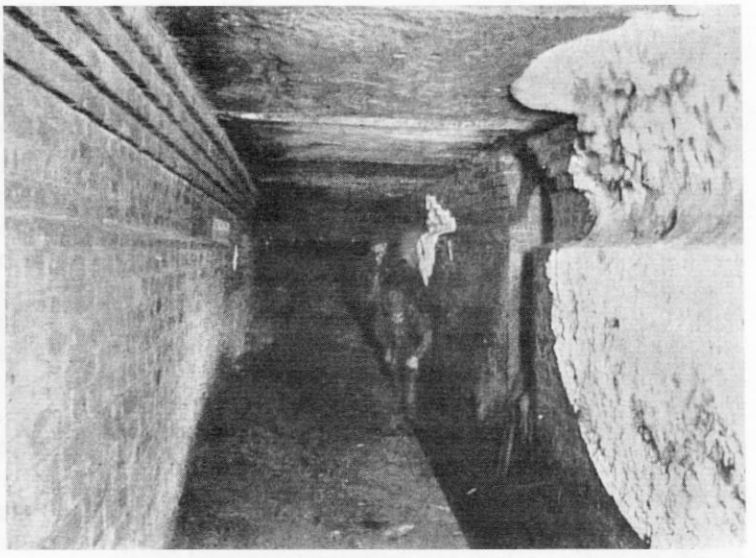
darkness of the arched passage in which we stood was dimly lighted up for a few yards around by our candles as we passed along and the lights and shadows danced and flickers up the walls and along the surface of the water like veritable 'Will o' the Wisps'.



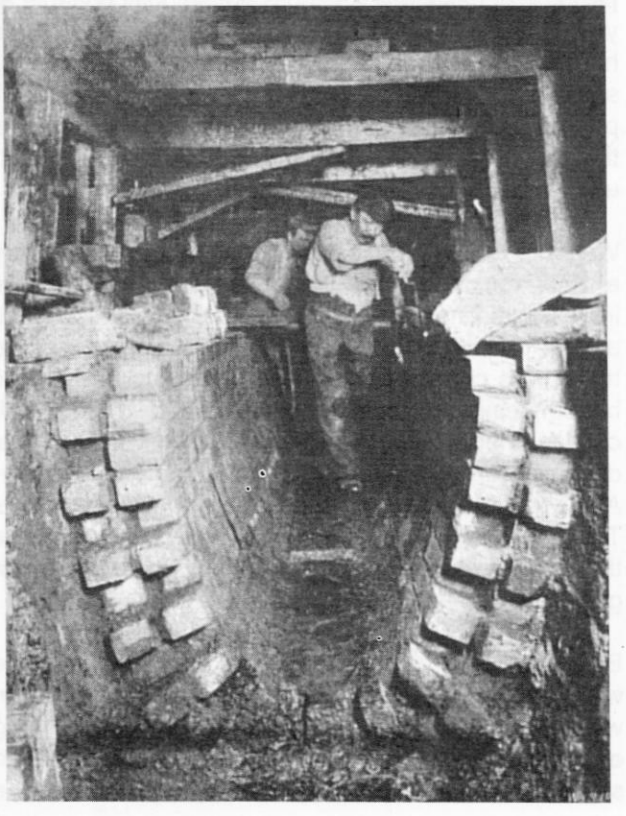
On we went, our progress necessarily slow for the bottom was slippery and the stream ran swiftly past our legs. My guide explained that when there was a heavy downpour of rain outside, the word was given and the men all went up to the surface, for the rush of water
filled the main almost up to the roof and the augmented stream came sweeping along with the rush and roar of a mountain torrent. "No" he said, "we don't have accidents, we can't afford to. If a man once got caught in such a torrent there'd be no saving him unless the water happened to be lower at the junction and he managed to regain his foothold otherwise he would be carried along with the stream until it discharged itself in the river at Barking. That's where he'd be found, at least what was left of him."

The water, as I have said, was only 1 foot to 18 inches deep but after this little conversation I found myself taking particular care as to how and where I put my feet down. Presently the photographer ordered us to halt and arrange ourselves; he wanted to take a group. Then a difficulty arose, his camera would rest upon its stand but where would he find a support for his flash light apparatus? Happy thought - a human stand! One of the sewer men was requested to bend down; upon his sturdy shoulders the apparatus was placed and then we all waited patiently until the magnesium wire flashed out and made us all blink.

Whether the picture was a success or not will be left to the reader to say. Possibly the subjects are not looking very well pleased, but when you are standing in a stream of running water and can feel yourself perspiring profusely under a lot of unaccustomed garments; while moreover the temperature is some 20 or 30 degrees higher than would be comfortable and your ryes are getting a little strained by the curious half light it is by no, means the easiest of tasks to obey the photographer's stereotyped command to "look pleasant". Our photographer was however a man of sense, he did not waste unnecessary time giving us minute instructions how to deport ourselves but having once got us focused and he 'took us' without further ado.

After being photographed some of the party seemed disinclined to go much farther. So leaving them in the broad main, the Superintendent, at my request took me to some of the side street and byways of the underground city. As we went, I seized on the opportunity of questioning him on his occupation; he seemed to think it was healthy enough.

"Oh yes, men get knocked up sometimes but it's more often through catching colds than anything else. You see it's hot down here and even if men loiter up above, especially in the cold whether, they are likely to get chills. No we don't often have men on the sick list with fevers or anything else of that sort. Why should we; it's healthy enough down here."



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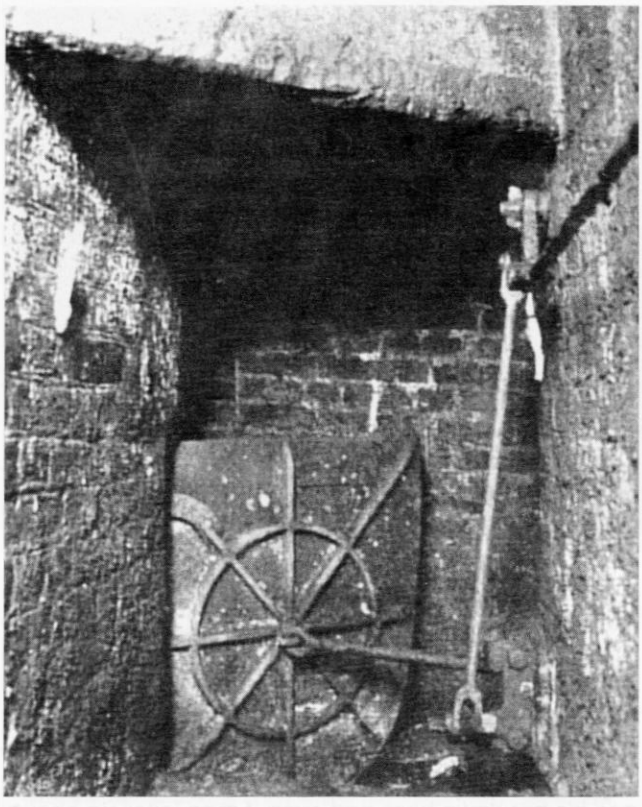


You can testify that the smell is no worse than you often encounter in the open street. Now and again of course when at a bend or a narrow passage there is an accumulation of sewage and the stream gets partially dammed; the men then have a rather unpleasant job to perform, but as a rule the job is not so objectionable as you imagine. Yes sometimes a man will stay down here for six or seven hours at a stretch and they may seem none the worse. Smoke? "Yes as you can see", pointing at his pipe, "it's possibly if we didn't smoke, the smells which we sometimes meet with might effect us more."

We entered one of the branches and conversation except for the most limited description became impossible. The roof was so low that we had to bend almost double to avoid damaging ourselves, add to this it was constructed on a sharpish incline and the bottom being slippery it was necessary to proceed with caution. Had my guide explained, had it been a wet day this branch would have been quite nonnegotiable. As it was, the water in it was only a few inches deep. This came from the surface as I very soon saw for at the top end was one of the gullies covered with an iron grating to be seen in the roadway.

Back we went as we had come passed the place where the main stream forks out into two branches, in which the current of course moves more slowly. Along one of these we then went up another branch, even smaller than the first and more difficult. From here the water was almost knee deep and was swirling and eddying like the river around the buttresses of one of the great bridges. Previously I mentioned to my guide that if possible I should like to get a glimpse of some of the rats with which the sewers abound. He had explained that although they came out more freely at night, he might be able to show me a few in one of the less frequented portions of the sewer; and this was the place he had chosen.

Painfully we made our way for some forty or fifty yards and then placing ourselves in a niche in the wall we waited but we didn't see a rat. Rather disappointed, we were just turning to go back when I fancied a saw a dark shape slip past our feet. It may have been a rat or merely a shadow. In all events I started and nearly lost my balance. With a clutch at my companion I regained it and as I stood upright I found that we were in total darkness. As I slipped, my sconce fell from my hand and was now being gaily borne eastwards at a rate of two or three miles an hour and in grabbing at the Superintendent I had inadvertently extinguished his candle and we didn't have a match between us. The only thing to do was to grope our way back in the dark. Luckily my companion could have found his way out blindfold and consequently laughed heartily at our predicament. He led the way and I followed touching him lightly every few yards to make sure I was in his tracks as the darkness was so intense that I could scarcely distinguish him.

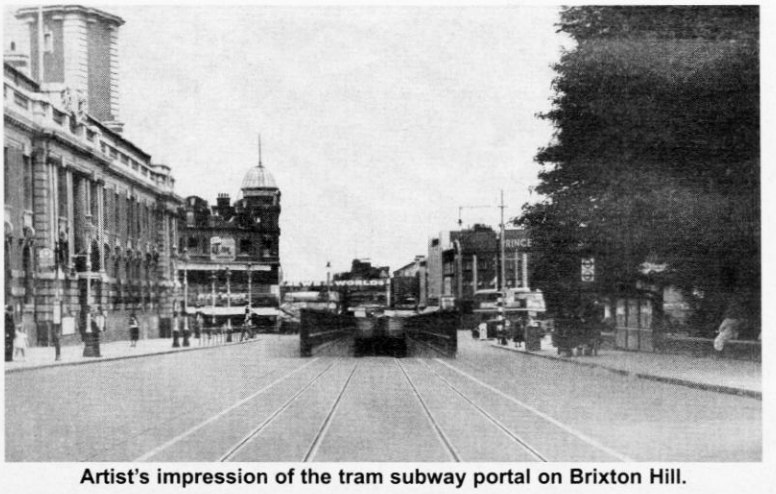
Now I have a curious fact to relate. The Superintendent declares it was my imagination but at the time I could have sworn that though no rats made an appearance when, with candles lit, we stood on the look-out, they simply came out in shoals and trotted about our feet when we were journeying slowly and painfully in the dark. Well it may have been imagination and perhaps the journey in the dark had played upon my nerves more than I cared to admit. When we rejoined the rest of the party they were all waiting and wondering what had become of us. They laughed heartily when we told our story and frankly expressed their incredulity when I spoke about the rats but they expressed no inclination to go and find out for themselves.

So back we all went to the shaft and one by one climbed up to the surface; how glad we were to get there! It was an exceedingly interesting experience and one that few people will have and that I think all of us fully recognised. But after a couple of hours in the nether world it was undoubtedly delightful to feel the fresh breeze blowing on our cheeks, to hear the busy hum and clatter of traffic and to see once again the glorious blue sky over out heads.

My Appologies for the poor quality of the pictures.

The Croydon Tramlink of 1950

After World War Two there a number of suggestions were put forward for improving travel conditions in London south of the Thames. One of these was to use the deep shelters built during the war at Clapham and Stockwell to enable express tube trains on the Northern Line to bypass the stations at these points. Shortage of funds meant that it never came to fruition, however.



Artist's impression of the tram subway portal on Brixton Hill.

In 1950 the Tramway Development Council revealed an equally radical plan, arguably more revolutionary than those planned Northern Line improvements or the Croydon Tramlink scheme opened 50 years later.

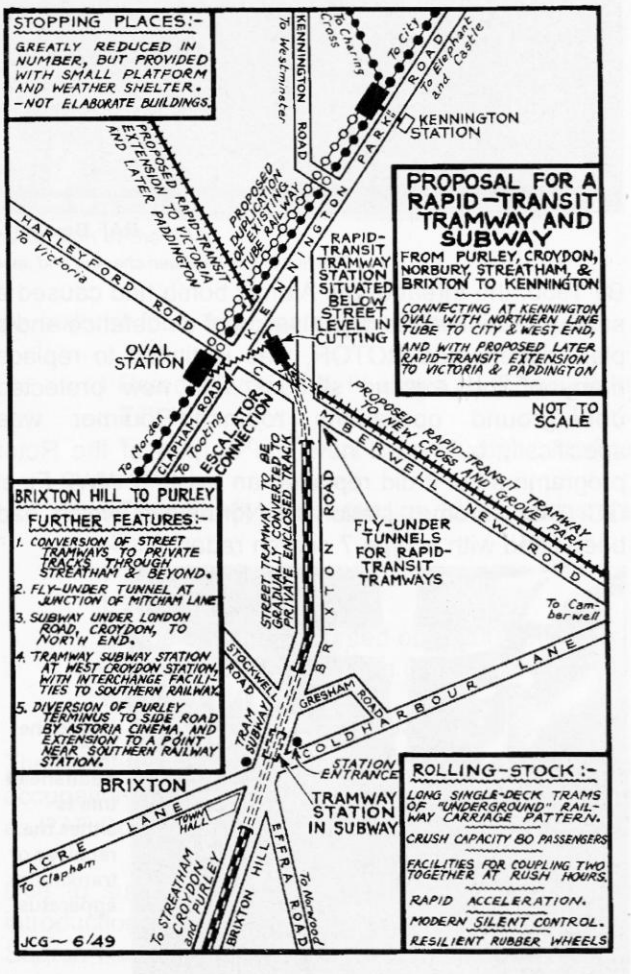
Laid before the public was a plan for a rapid transit tramway running at surface level and below ground along a corridor from Purley and Croydon to a major new transport interchange at Kennington Oval. Here the 'rail coaches' would interconnect with Northern Line tube trains to the City and West End, also with a future extension of the rapid transit line to Victoria, Marble Arch and Paddington.

The 1950 scheme anticipated Tramlink in almost every respect. The line would create reserved tracks for street running, with tunnels and flyovers to avoid traffic pinch points. Stopping places would be spaced further apart than with other modes of street transport, provided with small platforms and shelters for use in adverse weather. More elaborate stations would be provided at rail interchange points, including a substantial underground tram station in central Brixton where Acre Lane and Coldharbour Lane cross Brixton Road and Brixton Hill. An interchange station in cutting below street level was to give interchange at Oval tube station.

Twin-coach trains would be made up of long single-deck carriages (rail coaches) with a high power-to-weight ratio and rapid acceleration. Plenty of space would be provided for standing passengers, whilst resilient rubber wheels would reduce noise. Grass and flower borders would help make the reserved track sections more attractive and neat fencing would ensure pedestrians did not stray into the path of high-speed trams. A more elaborate development of this scheme covering more of south London appeared in The Modern Tramway for July 1950.

Regrettably none of this came to pass. In this era of austerity there was simply no money for major new capital investment, whilst the scheme also suffered the handicap of not emanating from London Transport itself. Nonetheless its technical conception was first class, as proved by the subsequent Croydon Tramlink, and to this day the Brighton Road corridor in south London still desperately needs transport improvement.

From Andrew Emmerson


STOPPING PLACES:-
GREATLY REDUCED IN NUMBER, BUT PROVIDED WITH SMALL PLATFORM AND WEATHER SHELTER. -NOT ELABORATE BUILDINGS.
KENNINGTON ROAD
To Westminster
To Christ's Cross
To City
To Elephant and Castle
KENNINGTON PARK
KENNINGTON STATION
PROPOSAL FOR A RAPID-TRANSIT TRAMWAY AND SUBWAY
FROM PURLEY, CROYDON, NORBURY, STREATHAM, & BRIXTON TO KENNINGTON
CONNECTING AT KENNINGTON OVAL WITH NORTHERN LINE TUBE TO CITY & WEST END,
AND WITH PROPOSED LATER RAPID-TRANSIT EXTENSION TO VICTORIA & PADDINGTON
NOT TO SCALE
PROPOSED EXTENSION OF RAPID-TRANSIT TO VICTORIA AND LATER PADDINGTON
PROPOSED DUPLICATION OF EXISTING TUBE RAILWAY
RAPID-TRANSIT TRAMWAY STATION SITUATED BELOW STREET LEVEL IN CUTTING
HARLEYFORD ROAD
To Victoria
OVAL STATION
To Morden
CLAPHAM ROAD
To Tooting
ESCALATOR CONNECTION
PROPOSED RAPID-TRANSIT TRAMWAY TO NEW CROSS AND GROVE PARK
BERWELL NEW ROAD
BRIXTON ROAD
FLY-UNDER TUNNELS FOR RAPID-TRANSIT TRAMWAYS
To Camberwell
BRIXTON HILL TO PURLEY
FURTHER FEATURES:-
1. CONVERSION OF STREET TRAMWAYS TO PRIVATE TRACKS THROUGH STREATHAM & BEYOND.
2. FLY-UNDER TUNNEL AT JUNCTION OF MITCHAM LANE.
3. SUBWAY UNDER LONDON ROAD, CROYDON, TO NORTH END.
4. TRAMWAY SUBWAY STATION AT WEST CROYDON STATION, WITH INTERCHANGE FACILITIES TO SOUTHERN RAILWAY.
5. DIVERSION OF PURLEY TERMINUS TO SIDE ROAD BY ASTORIA CINEMA, AND EXTENSION TO A POINT NEAR SOUTHERN RAILWAY STATION.
STREET TRAMWAY TO BE SPECIALLY CONVERTED TO PRIVATE ENCLOSED TRACK
STOCKWELL ROAD
TRAM SUBWAY
GRESHAM ROAD
COLDHARBOUR LANE
STATION ENTRANCE
TRAMWAY STATION IN SUBWAY
BRIXTON
ACRE LANE
TOWN HALL
To Clapham
To Streatham, Croydon and Purley
BRIXTON HILL
EFFRA ROAD
To Norwood
JCG ~ 6/49
ROLLING-STOCK:-
LONG SINGLE-DECK TRAMS OF "UNDERGROUND" RAILWAY CARRIAGE PATTERN.
CRUSH CAPACITY 80 PASSENGERS.
FACILITIES FOR COUPLING TWO TOGETHER AT RUSH HOURS.
RAPID ACCELERATION.
MODERN SILENT CONTROL.
RESILIENT RUBBER WHEELS

The line of the proposed tramway between Oval and Brixton showing the position of the two subways and the underground interchange station at Brixton.

RAF Boulmer

RAF Boulmer - The Guardhouse

The text below has been checked and approved by the Commanding Officer RAF Boulmer.

By 1950, the threat of the Atomic bomb had caused a serious rethink in the organisation of air defence and a plan, codenamed ROTOR, was instituted to replace many of the existing stations with new protected underground operations rooms. Boulmer was specifically built on a new site as part of the Rotor programme but it did replaced an existing WW2 Final GCI (happidrome) station at Northstead which had been fitted with a Type 7 search radar.

inside the R12 at Neatishead this is either the receiver or transmitter apparatus.

A site that was chosen for the new Ground Control Intercept (GCI) station was close to an existing airfield (RAF Boulmer) which has been returned to agriculture at the end of WW2. The station was to have a two level underground operations room designated as an R3.

The R3 was never intended to survive a direct hit from a nuclear weapon but was designed to withstand a near miss from Russian pattern bombing with 2,200lb armour-piercing high explosive bombs (BRAB) dropped from 35,000 feet.

The target date for completion of the station was 21st August 1953 and although not complete, the station opened on time with limited capabilities using an American AN/FPS3 long-range search radar and an AN/TPS10 height finder. The station was known as 500 Signals Unit under the control of RAF Acklington and part of 13 Group.

The R3 was complete and the site fully operational in September 1954. RAF Northstead closed and the personnel moved to the new domestic site at Boulmer. This was divided into two sites accommodating 'officers & NCOs' and 'other ranks'. The

RAF Boulmer

RAF Boulmer - 1982 Construction of the R3A

accommodation was Seco hutting with a married quarters estate.

The Type 7 radar as Boulmer was remotely sited a mile to the east of the technical site on the old airfield (now Field House Farm) with a ten core coaxial cable linking it to the R3.

The transmitter, receiver and motor for turning the aerial array were located underground in a bunker designated as an R7 and known as a 'well'. Because of the distance from the main site, this radar required its own IFF and an Mk 10 IFF was mounted on a Type 14 plinth, turntable and cabin. This arrangement of IFF and plinth was designated Type 79. This was located a short distance to the east of the R7 bunker with a small brick built electricity sub station alongside.

Remote VHF transmitter and receiver blocks were also sited at High Buston and a standby set house (generator) for the technical site was located at the 'other ranks' domestic site. Mobile reserve sites were also selected and prepared. Two CEW reserve sites at Embleton Moor and Christion Bank and an unknown GCI reserve site.

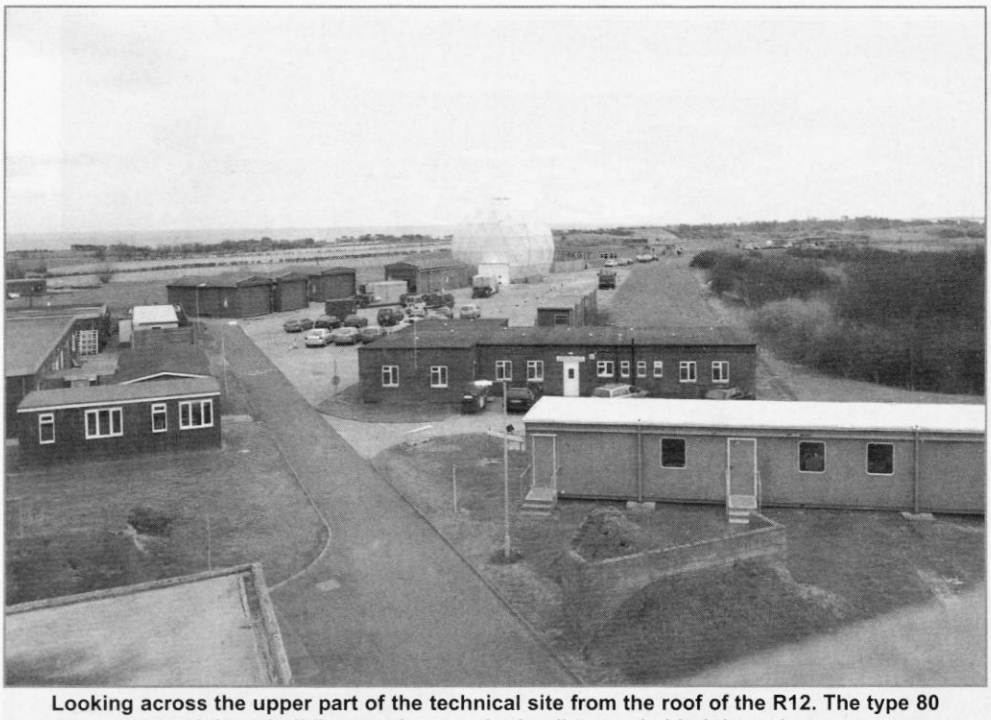
As built the following radars were fitted:

1 Remote Type 7 Mk III above an R7 well with a T79 IFF.
4 Type 13 MK VII mounted on 9' high concrete plinths.
2 Type 13 Mk VI mounted on 12' high concrete plinths.
1 Type 14 Mk VIII.
1 Type 14 Mk IX.
1 Type 54 Mk 3 mounted on a 200' tower for Centimetric early warning (CEW).
1 Type 79 Mk 1.

The underground operations room was ready for occupation in 1954 with the station coming fully on line as RAF Boulmer.

Due to supply and development problems with the introduction of a 'home-grown' long-range Centimetric Search Radar (Type 80) the station continued to use the American AN/FPS3 long range search radar and an AN/TPS10 height finder but in January 1956 a Decca Type 80 Mk. III search radar was finally

RAF Boulmer



Looking across the upper part of the technical site from the roof of the R12. The type 80 modulator building can be seen in the distance behind the radome.

installed and undergoing acceptance trials. The Type 80 was developed in the early 1950s from an experimental design based on the Type 14 Mk VI under the project code name Green Garlic; it replaced the earlier Type 7

Almost overnight, this radar made earlier air defence radars (dating from WW2) mostly redundant. The Type 80 improved the range of the station considerably with a range of up to 320 miles compared to the 90 mile range of the Type 7; this instantly made some of the earlier equipment obsolete. Following the installations of the Type 80 the two Type 14 radars were dismantled and removed. The Type 7 was kept in reserve in case of breakdown or maintenance of the Type 80.

Inside the R3, dramatic changes were also taking place. The large two storey operations room was superseded by a much smaller control room constructed on the top floor at the opposite end of the building.

This included a 'well' in the floor for a photographic display unit (PDU) which allowed radar pictures to be projected up into a plotting table above. This apparatus, located in the room below was a Kelvin Hughes Photographic Projector; this comprised equipment that could record the radar image on 35 mm film, develop, fix and dry the image and then project it up on to the plotting table in the control room on the floor above. The displayed image was only one minute behind real time. The PPI image from a high intensity cathode ray tube was projected on to the film through a focusing lens. Each revolution of the radar antenna took 15 seconds and it took this time to expose the film to a full revolution. At the end of the sweep, the frame would be moved on to be developed, whilst the next frame was exposed. When the frame moved on at the end of the next sweep the image was fixed, it then moved on again to be dried.

Finally, the frame moved on once more where it was projected, via a mirror, to the underside of the frosted glass plotting table on the floor above. Meanwhile the next frame to be exposed has been following on through the process, so at the end of the next revolution this frame was projected, 15 seconds after its predecessor. As frame after frame was displayed on the map the plotters in the pit could place markers on the map to indicate friendly or hostile aircraft.

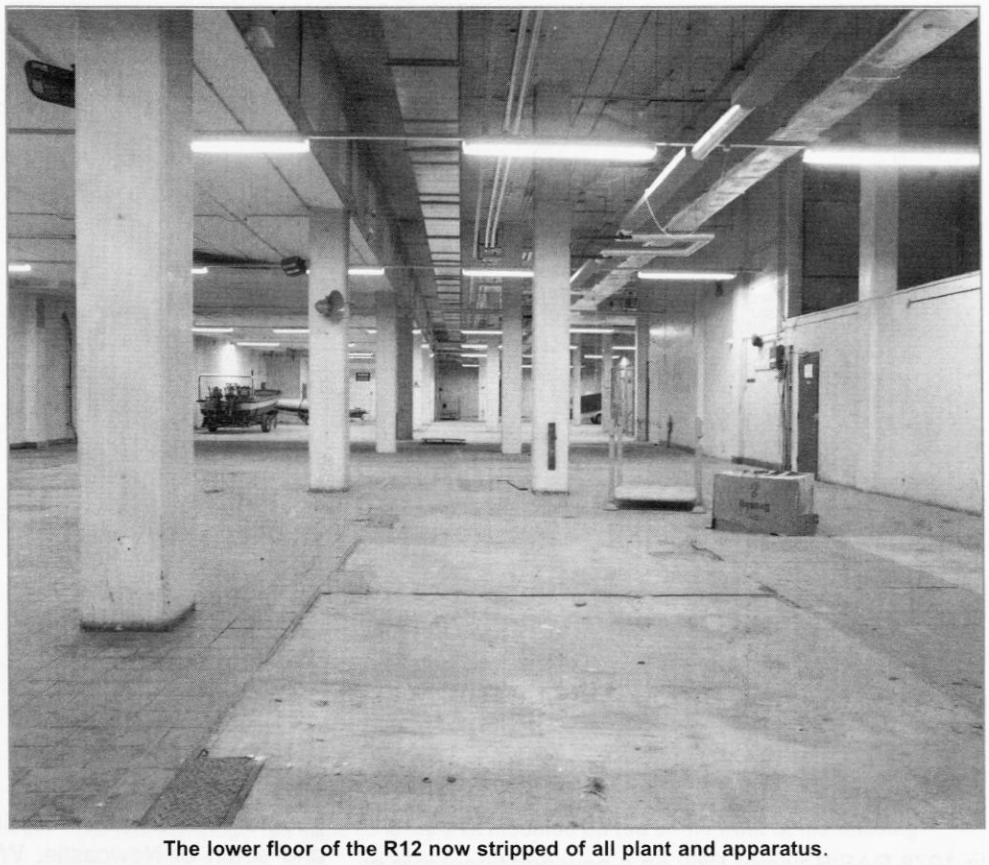
By December 1956, the main role of the station was a reporting role for Northern Sector and a standby reporting role for Eastern and Caledonian Sectors and for Killard Point in Northern Ireland.

The station took part in Exercise FORMULATE in 1956. Which involved 21 Meteors making a simulated attack from Germany on Northern Sector. The Type 80 performed well, although it was adversely affected by cloud cover, but the limited range of the Type 7 proved to be a handicap. RAF Seaton Snook also took part in the exercise using Type 7 and Type 13 radars and during the exercise 432 Light Anti Aircraft regiment defended the base.

In the 1956 Signals Plan, Boulmer was designated as one of 9 Master Radar Stations, RAF Anstruther was a satellite of Boulmer. In April 1957 it became a comprehensive GCI station. In November 1957 RAF Boulmer became 13 Group Control Centre, responsible for the GCI stations at RAF Buchan in the north of Scotland, RAF Killard Point in Northern Ireland and limited commitments from RAF Patrington (Eastern Sector MRS). It also assumed the role of Sector Operations Centre from RAF Shipton which closed.

RAF Boulmer

Under the 1958 Signals Plan, Boulmer was retained as the 13 Group Control Centre and Headquarters, a Comprehensive Station and Master Radar Station responsible for Buchan, Hackett (Benbecula) and Killard Point and the CEW stations at Saxa Vord and Aird Uig. This plan was later abandoned in favour of the Linesman/Mediator system with 3 SOC's at Buchan, Boulmer and Neatishead.



The lower floor of the R12 now stripped of all plant and apparatus.

As part of the 1958 Plan Boulmer was selected to be upgraded with the installation of new high powered Type 84 Surveillance radar mounted above an R17 modulator building. This increased the range of detection and was able to penetrate the latest Soviet jamming technology. The Type 84 was unable to establish height so two HF200 height finders were also added.

In 1966 the following radars were operational under Linesman/Mediator:

Type 80

Type 54

2 x HF 200 Height finders,

Type 84

2 x AN/FRS6.

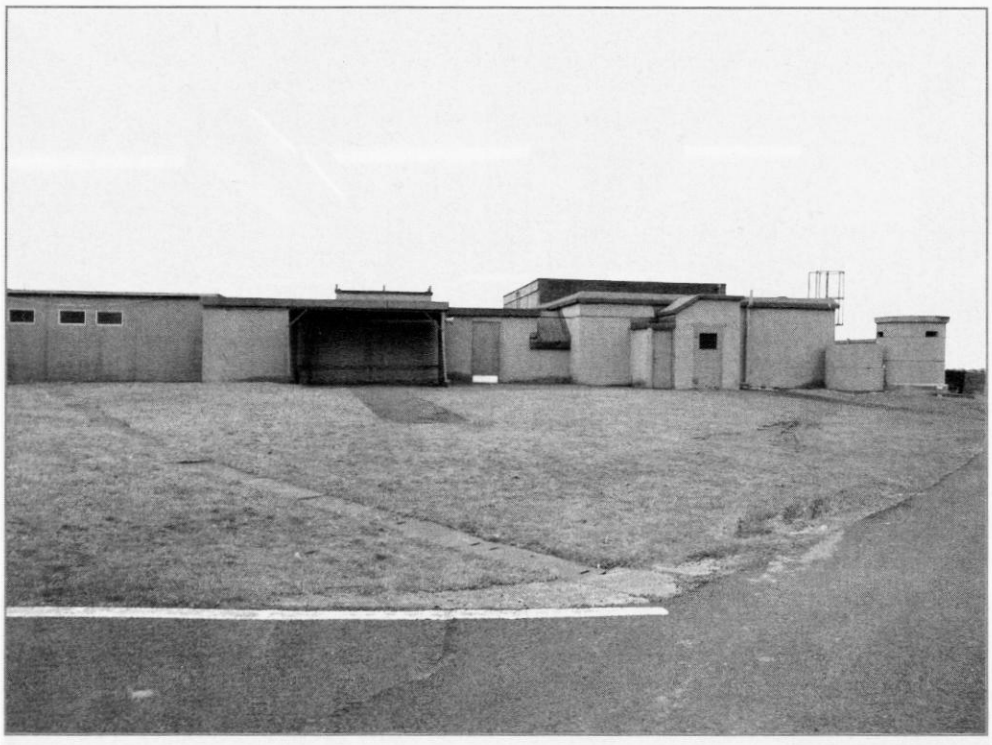
In addition work also started on the installation of a Type 85 radar. This too was able to cut through the Russian jamming with a range in excess of 200 miles; it was also equipped with banks of transmitters and receivers which could rapidly change transmitting frequencies to deter hostile blocking attempts.

In order to achieve this performance it required a set of five powerful diesel generators which would have been capable of supplying sufficient power for a large town. This radar was housed in a massive 3-storey R12 concrete technical block with a second block alongside housing the generators. Flight trials started in August 1967, but the radar did not come fully on line until 1968. The R12 was one of three around the county, the others being at Neatishead and Staxton Wold. In a further attempt to deter Soviet jamming, a passive defence system known as 'Winkle' was introduced on 1965. This consisted of a high speed aerial mounted above an R15 data handling building. This system, known as RX12874, worked with the Type 85 to establish the position of a jamming source.

In 1971 a nuclear reporting cell was operational at Boulmer. The same year Border Radar was established at Boulmer, this was a joint military/civil facility providing air traffic control services to coordinate civil and military traffic. Although still operational until the late 1980s, this closed when West Drayton took over control

Boulmer was now part of SLEW/UKADGE a centralized air defence system for the UK. By 1974 the station had been upgraded to the Northern Sector Operations Centre (SOC) and a Control and Reporting Centre (CRC). By this time command was maintained centrally at two sites, West Drayton and Strike Command HQ, High Wycombe and control was allocated to four CRCs at Bishops Court, Neatishead, Buchan and Boulmer. The sites were linked together so that one could take over from any other in an

RAF Boulmer



The Type 80 modulator building

emergency.

In 1978 RAF Boulmer took on a new additional role as a search and rescue station following the closure of RAF Acklington, a role that it still fulfills today. Initially the station was equipped with Westland Whirlwind helicopters but in December 1978 these were replaced by the Wessex and then the more versatile Sea King. The search and rescue facility is located on the domestic site 1 mile east of the technical site.

The next major change came in 1982 when the R3 bunker was vacated and rebuilt as an R3A. During this period the CRC was relocated to an above ground facility while the work was carried out. The Boulmer Interim facility, or BIF, is still in place and until recently was the home of No 1 Aircraft (No 1 Air Control Centre) Control Centre (No 1 ACC).

The alterations were substantial and involved the excavation of the underground R3 structure. The original two-level operations room was converted into two single-level operations rooms. New plant rooms, air intakes and vents were also added almost doubling the size of the existing structure; this included standby generators which had previously been located in a separate building on the domestic site. At the entrance to the core of the bunker, a new suite of decontamination rooms was added capable of handling the full gamut of nuclear, biological and chemical threats. Folding bunks were also fixed to the corridor walls for emergency sleeping in the event of the bunker being sealed. Further details of this work will be found in the description of the R3A below. Similar refits were undertaken at Neatishead, Buchan and Ash.

Following the extensive refurbishment, installation and testing of the highly advanced Integrated Command and Control System (ICCS), the R3A was returned to operations as a limited CRC in 1992; however, by this time the cold war had all but ended and control and reporting was downgraded and concentrated at Buchan and Neatishead, each with their own geographical areas of responsibility, roughly split north and south of Newcastle. Within their own areas, the CRCs received and processed information provided round-the-clock by military and civilian radars to produce the Recognised Air Picture (RAP). In addition to this radar data, the CRCs also exchanged information using digital datalinks with neighbouring NATO partners, AEW aircraft and ships.

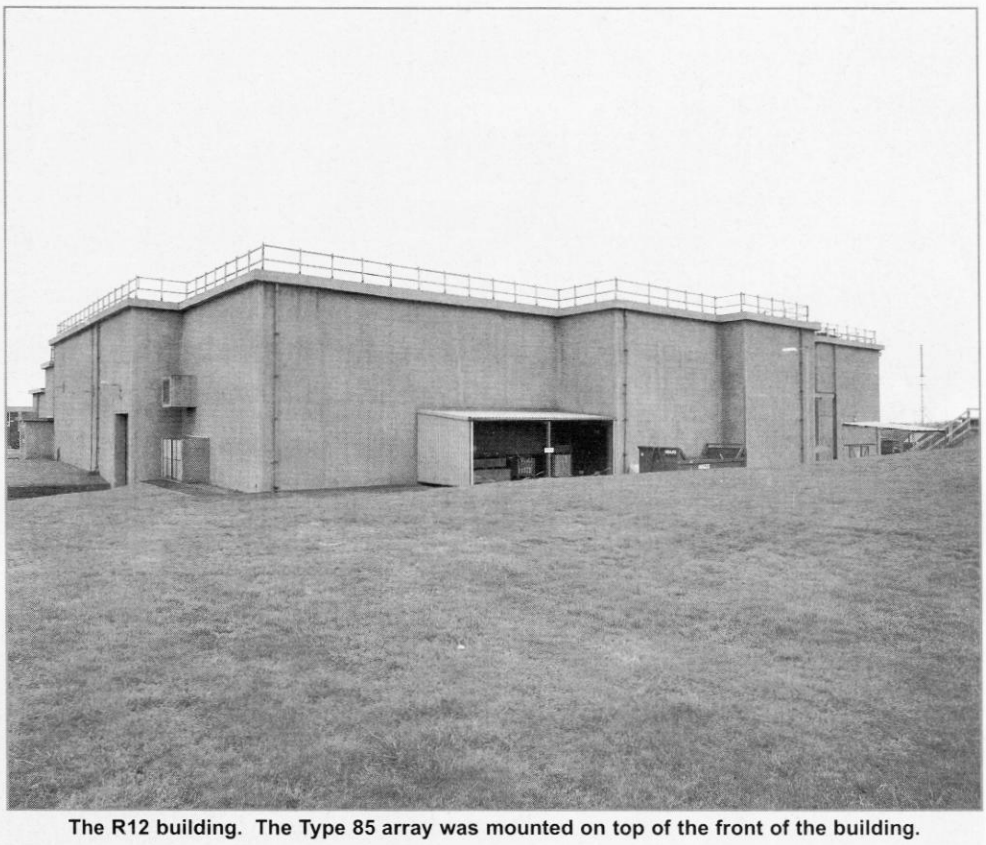
However, the production of the RAP was only one part of the CRC's duties, the second being the control of aircraft. While Fighter Controllers provided the tactical control required for our Air Defence aircraft to police the UK's airspace in peace and war, they were also involved in the peacetime training of the RAF's Air Defence assets. Moreover, Fighter Controllers also provide support to Ground Attack forces when undertaking training with their Air Defence counterparts, and close-control of Air-to-Air Refueling missions. During this period Boulmer was retained as a standby facility able to take over should either Buchan or Neatishead be taken off line.

By the end of the 1980s the Type 84 radar was redundant and was dismantled and sold for scrap in September 1989. The Type 85 remained in use until October 1990, though it too was dismantled in November 1991. The radars were replaced by the smaller Type 90 series which, although smaller, utilised modern technology giving them a greater range while using considerably less power. Being small and mobile

RAF Boulmer

they could easily be hidden from attack and quickly moved to provide early warning wherever it was needed.

In 1990 the School of Fighter Control moved from West Drayton to Boulmer and was located on the technical site.



The R12 building. The Type 85 array was mounted on top of the front of the building.

Further alterations took place in 2002 as part of the UKADGE Capability Maintenance Programme (UCMP). This £60m refit included the removal of the original consoles in the two operations rooms which have been replaced with a new 'off the shelf' computer systems with flat screen monitors. Primary Contractors for this refit were IBM for the data handling and display, and Frequentis for the communications systems. After the refurbishment, the CRC was back on line on 16th August 2004 and on 1st September 2004 Boulmer took over control and reporting for the whole country with the draw down of CRC Buchan. In order to develop the UK Command and Control System (UCCS), and demonstrate proof of concept, an additional, above-ground operations room (known as ABACUS) was installed at the same time as the underground system at Boulmer. It was originally intended to use this as the standby facility until Neatishead could be re-fitted. ABACUS is fully integrated into UCCS, and can operate independently or as part of an integrated system.

Thus it would be that the UK ASACS would retain 2 CRCs, albeit both at Boulmer for a brief period. However, even before the new Boulmer CRC was fully operational, it was announced that Neatishead would not reopen as a CRC; instead, a new CRC is currently under construction in an existing surface building at RAF Scampton. When this is fully operational, expected to be in early 2006, ABACUS will close. The future of Boulmer as a CRC is unsure. It may continue as is, but it is more likely that it too will eventually close in favour of a second above-ground facility that could allow the Fighter Controllers and Fighter aircraft to be co-located.

RAF BOULMER TODAY

Although Boulmer's role has changed radically over the years many of the buildings from all periods survive and some have been put to new uses. The R7 bunker on Field House Farm survives although in recent years it has been covered over with soil and its site can only be determined by a slightly raised area covered with thick grass. The adjacent IFF plinth and powerhouse have been demolished. On the technical site the Type 80 and R17 modulator building also survive as does the R15 data handling building. All of these are well within the technical site and cannot be seen from a public road. The most obvious survivor is the massive R12 which can be clearly seen from the adjacent road. The three-storey building consists of three vast halls surrounded by a number of smaller rooms.

On the ground floor, the building was roughly divided in two with the two large rooms housing the Type 85 transmitter apparatus and the air conditioning plant. The upper floor consists mainly of one large room which housed the Type 85 receiver and passive tracking apparatus. The half height basement contained some apparatus and was latterly used as a nuclear fallout shelter for the station. The Type 85 array was mounted on the front of the roof beneath a

RAF Boulmer

CRC Boulmer Upper Operations Room, Air Surveillance Suite.

two-storey 'tower' which contained the waveguides.

The building has now been completely stripped of any original fittings and is little more than a shell. The kitchen on the upper floor retains some of its fittings with a serving hatch into the adjacent rest room/canteen. The two-storey loading bay still retains its power hoist. The roof of the building gives a superb view overlooking the station. Its most recent use has been as a tent drying and storage facility for No 1 ACC.

The original stone-built guardhouse has been retained as the main entrance to the R3A although the original verandah has been built-on to, to create extra rooms. The water tanks in the roof have been removed and dormer windows to the rear have been added to provide new office space. The original stairs at the rear of the guardhouse give access to the entrance tunnel.

The area that would have housed the ROTOR period transformers has been converted into office space. Evidence of the old blast doors still remains on the bend in the corridor; beyond the dogleg is the top of the main staircase at one end of the central spine corridor. The original plant hoist over the stairwell still exists.

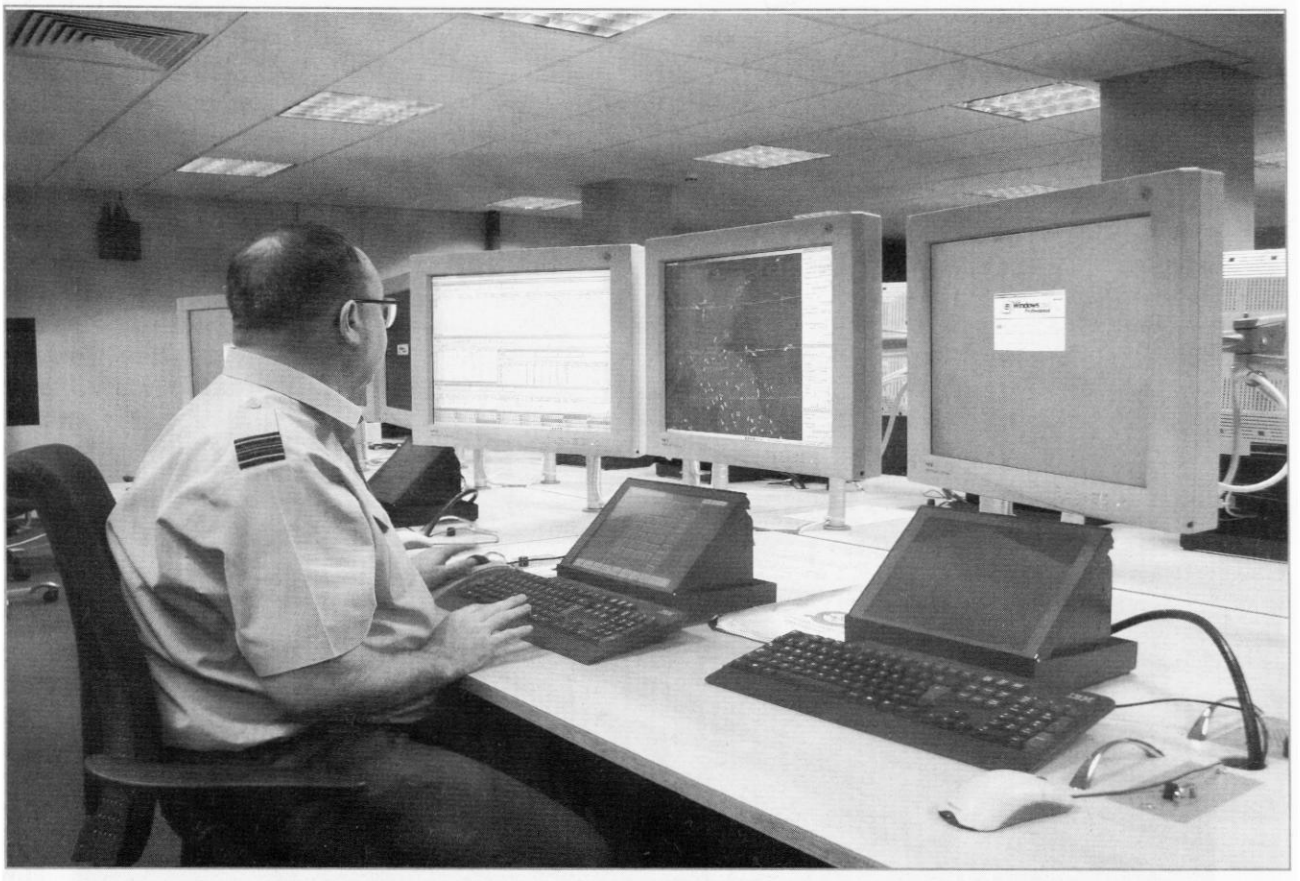
The major changes to the top floor consist of the removal of all of the floors within the operations room and a new suspended floor. The kitchen has been adapted to provide very basic mess facilities; restrooms are still roughly in their original configuration the only difference is the level of segregation is not so strict.

Many of the other rooms on the upper floor have now been converted to office space. Moving out through the doors past the stairs at end of the upper spine corridor there is another substantial pair of blast doors in the position of the original 1950s doors. Turning through the dogleg into the exit passage is the chamber where the original 'Cyclones' (providing cooled water to the AC plant) were once fitted.

A very sturdy 10mm welded steel plate blocks off the bay where the cooling fans (at the base of the 'Cyclone') would have sat. At the top of the original emergency exit stairs a new tunnel has been added leading two exits, one to the left and one to the right. Further rooms are to be found on this level for air conditioning and filtration plant

The whole bunker has been gutted throughout of most of the original 1950s fittings and a whole new air conditioning system and plant room installed. Some walls had been removed from the original layout.

RAF Boulmer



An UCCS Console Showing the Operator (Left) and Assistant Positions. The console has a Geographic (radar) display in the centre, with separate Tote Displays for the Operator and Assistant.

Opposite the plant room is the Lower Operations Room; this has the floor on the same level as the lower corridor. During the ICCS era, this ops room was stepped, with the senior people in the organization on the upper levels, looking over their subordinates.

However, that has all changed under the UCCS. The Master Controller in overall charge of CRC Operations now sits in the centre of this room, with his senior executives (Planning FA and Surveillance Director) close by. Either side of the center bank of consoles sit the Surveillance and Weapons Teams respectively. The Surveillance Team produces the Recognised Air Picture (RAP) for the whole of the UK Air Policing Area, whilst the Weapons Team controls fighters and tankers in support of peacetime training or Quick Reaction Alert Missions.

The most notable thing about the modern ops rooms, apart from the new technology, is the sheer brightness. Daytime light levels, despite being an aspiration for the ICCS, were never achieved. With UCCS, however, the levels of light in the ops rooms are very high indeed – during the winter months in this part of the UK, it is probably brighter underground than it is on the surface!

Back at the intersection in the main corridor a tunnel leads to the new plant rooms. Passing through a substantial blast door there is a long plain concrete corridor with a small mezzanine floor above providing access to a ventilation tower that was evident on the surface. Following this corridor down there is a large chamber with various red painted blast doors to the right and workshops and stores to the left.

The sheer size of this second bunker is wholly impressive as it is at least as big as the original 'R3' itself.

Photos and Text by Nick Catford - checked and approved for publication by the Commanding Officer RAF Boulmer.

Uxbridge AAOR

External view of the Uxbridge AAOR with the original entrance porch in the foreground and the distinctive ventilation stack on the right hand site. The extensions to the building by the USAF can be seen on the left and on the roof. The communications mast is still in use as part of the USAF microwave chain.

For many years there has been speculation about the existence of a post war Anti Aircraft Operations Room at RAF Uxbridge. It is mentioned in various documents and accounts at the National Archive (PRO) but until recently no conclusive evidence has been found to show that it ever existed.

It is not listed in Duncan Campbell's book 'War Plan UK' while AAOR's at Norwich and Falmouth are listed although they were never built. Cold War – Building for nuclear confrontation 1946 – 1989 (English Heritage) does list an AAOR and RAF Uxbridge but it also lists Norwich. Most documents relating to AAOR's at the National Archive don't mention it and it is clear that, if built, it was never used for its intended purpose.

Aerial photography of RAF Uxbridge was inconclusive and the press office and the stations historian were unable to provide any information to confirm that it was built on the station.

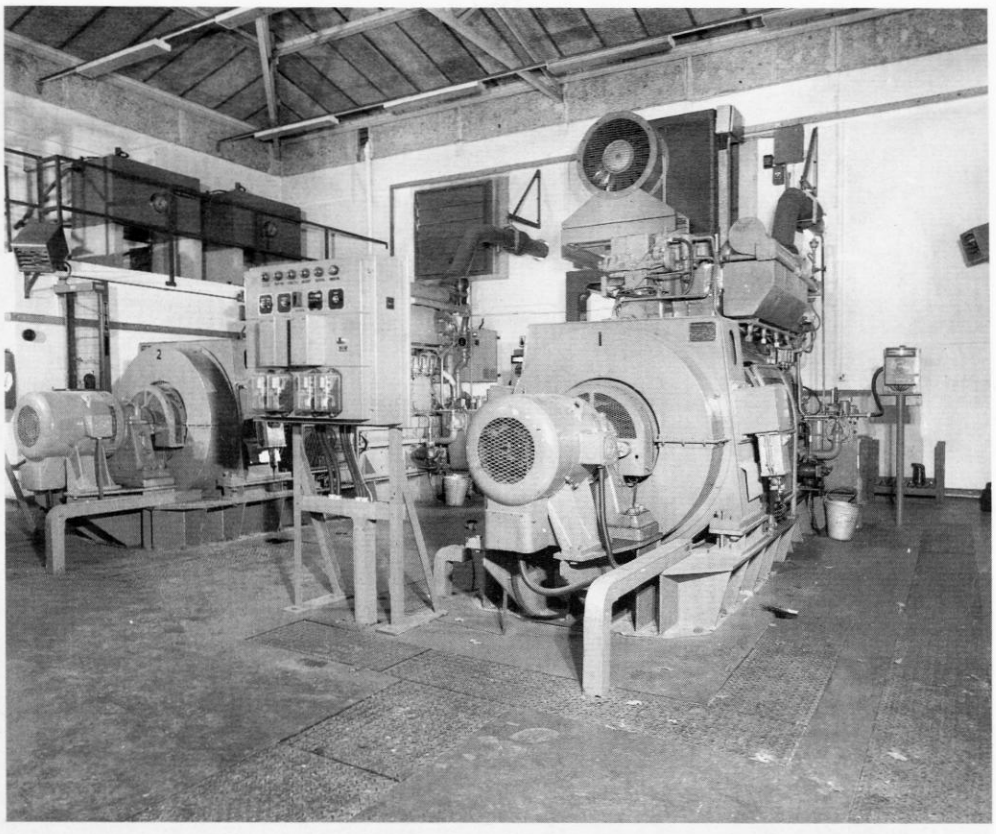
We can now confirm the existence of the Uxbridge AAOR; the building is tucked away close to the domestic accommodation at RAF Uxbridge and is currently empty but retained on care and maintenance by the US Air Force.

During WW2 the London Gun Defended Area (GDA) was known as the Inner Artillery Zone comprising of four clusters of Anti Aircraft Gun sites known as IAZN (North), IAZS (South), IAZE (East) and the Slough/Langley Group. All these guns were controlled from the four level underground Gun Operations Room (GOR) located at the disused Brompton Road tube station on the Piccadilly Line. In about 1942 a new GOR for the Slough/Langley Group was set up at Churchmead House, Datchet. The TA drill hall at Slough was also used for a time although control reverted back to Brompton Road in late 1944 with the winding down of the AA guns.

The guns of the Slough/Langley group would have

Uxbridge AAOR

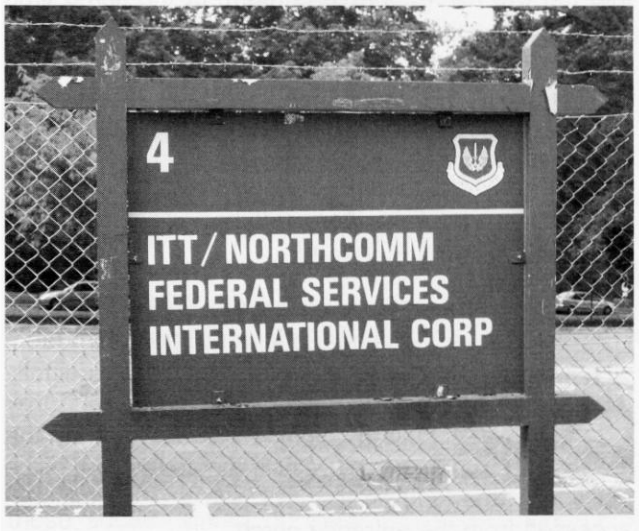
defended the numerous aircraft production facilities located to the west of London but not west London itself whose gun sites were in the North and South London GDA's. All the Slough/Langley sites were mobile with at best only earthwork emplacements. The once exception being Gallows Hill near Iver where concrete emplacements were provided.



The standby generator house in an adjacent compound

As part of the post war Rotor programme, the Army AA Command commenced a programme of building 32 AAOR's designed and built to service the new, fewer GDA's of the cold war. In 1946 a scheme called Nucleus was implemented to determine which guns sites would be used and by 1951 this had developed into the IGLOO scheme.

Igloo 1 sites incorporated some old WW2 gun sites and some new sites with concrete emplacements and other infrastructure either new or reused. Igloo 2 sites could have the same criteria as Igloo 1 but might only be provided with hard standings for the guns or might only be a presurveyed position with a GPO and power termination point. At Igloo 2 sites control rooms and magazines would be provided in Nissen accommodation kept with the guns at Anti Aircraft Ordnance Depots. Everything would be transported to the sites on mobilisation. None of the West London sites were even given an Igloo number.



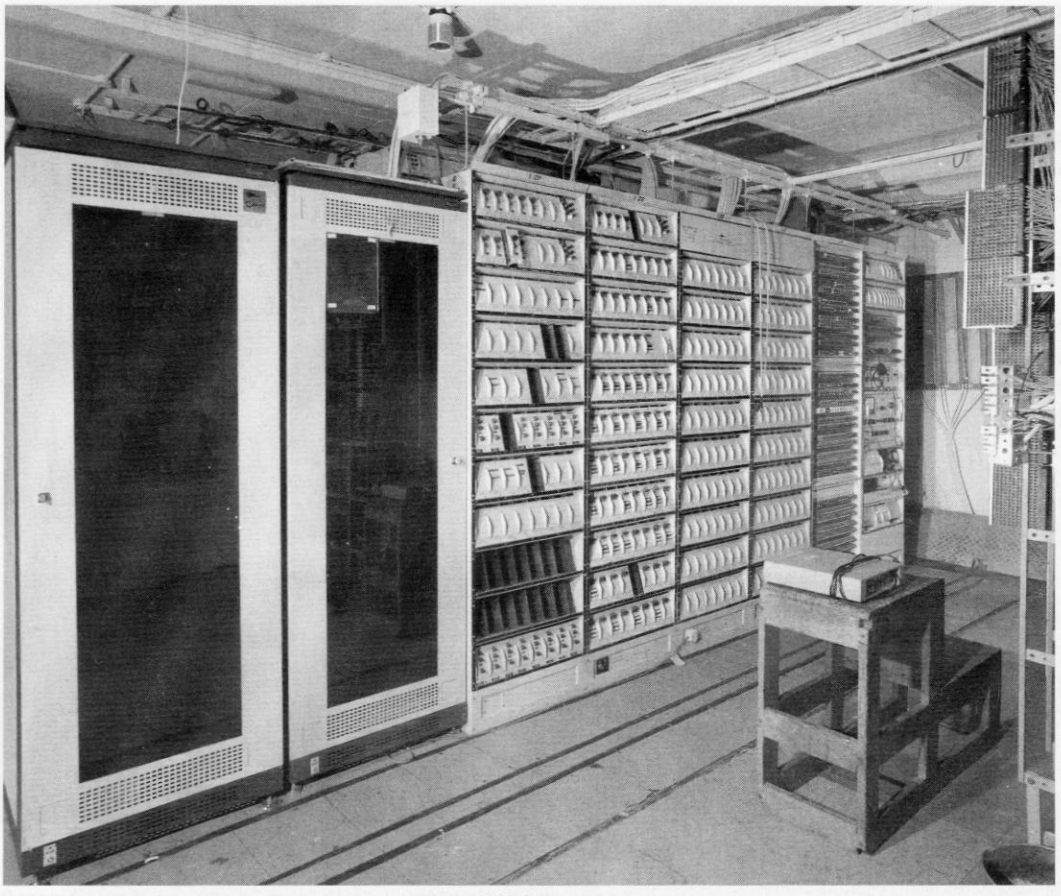
US Air Forces in Europe sign at the entrance to the compound

During the construction period, Brompton Road remained operational while the three two storey protected control rooms were built for the GDA's covering the London Area. The London North GDA was served by an AAOR at Lippetts Hill in Epping Forest. London South was served by an AAOR at Pendell Camp near Merstham in Surrey. London West, covering the old Slough/Langley Group was to be controlled from an AAOR at RAF Uxbridge.

Whilst a lot of new infrastructure in the North and South areas, including brand new sites with permanent control rooms and standby generators, at West London no new infrastructure was provided at any site. According to the 1951 AA Mobilisation Plan, the West London AAOR was under the command of 1 AA Group, Southern Command, Salisbury Plain District. Although not designated as such, all the sites were of the Igloo 2 variety, being a presurveyed site where guns and Nissen and tented accommodation would be provided on mobilisation.

Eight sites came under the control of the Uxbridge AAOR. These were Braywick (SU914805), Forty

Uxbridge AAOR



The GPO frame room

Green (SU924912), Whaner (SU978913), Winter Hill (SU884864), Tally Ho Gorse (SU905755), Iver (TQ034834), Dorney (SU941785) and East Burham (SU957848). Iver was the WW2 site with reused emplacements (nothing remains today)

In addition, the AAOR would be connected to light anti aircraft units defending the main aircraft factories and other important sites in the area. These too would be serviced by mobile guns and control rooms (LAAC) that would be transported to the presurveyed sites on mobilisation. LAAC locations were the Langley/Slough aircraft factories, Windsor Castle, Bomber Command HQ High Wycombe, RAF Chenies Rotor GCI station.

By the early 1950's, with the closure of most of the aircraft production facilities to the west of London, the requirement for an AAOR diminished to such an extent that the area was given low priority over North and South Areas. It appears that the AAOR at Uxbridge was commissioned quite late, if at all, with the area being absorbed by London North and South. It is doubtful if any of the communications were installed by the stand down of AA Command in 1955.

In 1959, it was proposed to build a launch co-ordination centre for Blue Streak sites in the south east either in the Uxbridge AAOR or in the old 11 Group (Battle of Britain Control room) bunker which was also located on RAF Uxbridge. This would have coordinated launch control centres in charge of a flight of missiles at proposed launch sites such as Chenies and Odiham. The whole project was cancelled and the site remained empty.

By 1962 the building had been handed over to the US Airforce who required protected accommodation in West London for an Autovon military telephone exchange. The Autovon exchange at Uxbridge and a similar installation at Martlesham Heath near Ipswich comprised the hub of the US Autovon network in the UK.

In order to fulfill this role numerous alterations to the building were made, internally a new floor was inserted into the two level operations room; at the same time the balcony and glass fronted cabins overlooking the well were removed. These two rooms housed the main Autovon exchange equipment. On the upper floor, numerous partition walls that formed the original rest rooms were removed to make two long rooms, one either side of the former operations room. Four if the original five stairways were retained while the other one was walled off at the top.

The original entrance porch on the upper level was converted into a switchgear and ventilation plant room with the main entrance located at what was originally the back entrance. A prefabricated two storey extension was added to one side with access from the lower floor while a new brick single storey office building was added on the roof with a new staircase accessed from the entrance porch.

Uxbridge AAOR

A separate standby generator house, housing two large diesel generators and associatred control equipment was also built adjacent to the AAOR in its own compound and separate from the rest of the buildings which were enclosed within a new secure compound.

The building remained in use until 2002 after which date it was completely gutted apart from the plant and equipment in the BT frame room.

The lower level of the former operations room which house Autovon apparatus racks

Although now surplus to requirements the building is retained on care and maintenance. The ventilation plant is kept running 24 hours a day and the building is still heated. A large lattice communications mast stands within the compound; this is still in use for a relay station in the USAF microwave chain.

Despite the additions the building is still externally recognisable, retaining its distinctive ventilation stack at one corner. The main access to the building is through the rear entrance porch with emergency access through the rooftop extension and down a new external metal stairway.

The room layout on the lower floor is largely unaltered with the ring corridor remaining intact. The former standby generator room at the bottom of the main stairs now houses electrical switchgear. The original ventilation plant on the opposite side of the lobby has been removed with a new fan and trunking feeding all the rooms in the bunker; further new ventilation plant can be found on the upper level. Adjacent to the plant room, the boiler room retains its original function although now fitted with a modern boiler.

Two rooms have been fitted with 'safe' type doors with combination locks for secure storage. Opposite one if these secure stores on room has been paneled in wood. There is clear evidence of where equipment rack stood in the former operations room which has its new false ceiling supported by several sturdy concrete pillars. The adjacent BT frame room is still intact with its main distribution frame and ancillary equipment still in place. Although some circuits appear to be live the American's cut most of the cables before they vacated the building.

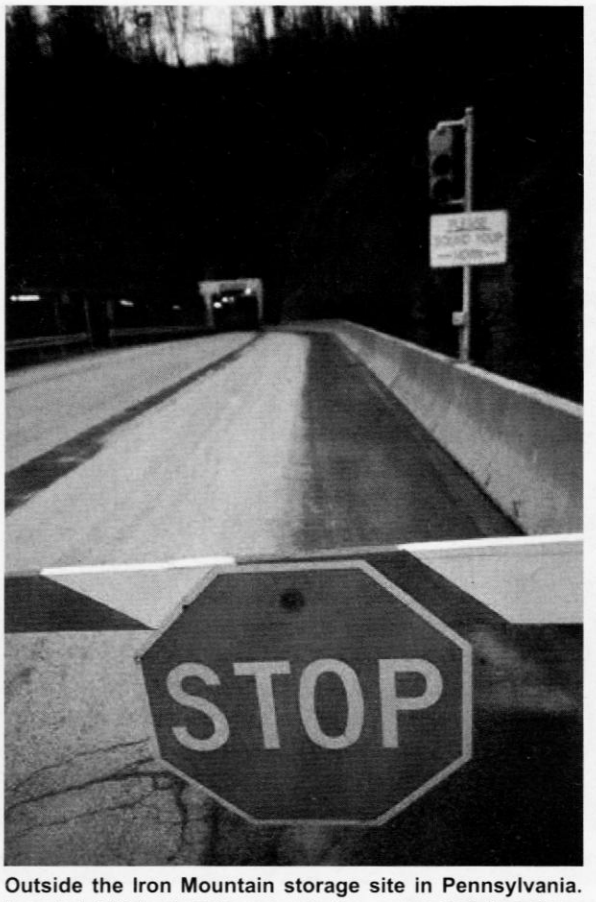
On the upper floor, two sides of the ring corridor have been removed creating the two large rooms previously mentioned. The toilets and wash rooms have been retrained in their original positions although refitted.

All the Autovon equipment appears to have been located within the protected AAOR building while the extensions to one side and on the roof appear to be office accommodation. All the rooms are now empty and their original use is unknown and cannot be determined.

The brown and white 'US Air Forces in Europe' board at the entrance to the compound shows the building to be No 4 and allocated to 'ITT/Northcomm Federal Services International Corps'

Photo's and Text From Nick Catford

Iron Mountain



Outside the Iron Mountain storage site in Pennsylvania. Located 200-feet underground, the converted limestone mine houses secure temperature and humidity-controlled archival facilities for the Corbis Film Preservation Facility, as well as most major movie studios, government agencies such as the National Archives and Library of Congress and numerous private businesses.
Image: © James Leynse/Corbis

"Go down this road, cross two railroad tracks and go through one stop sign. Turn left at the picnic area and look for the tunnel among the rocks."

The directions are almost as mysterious as the mine itself. There are no welcome signs, or any signs at all, to one of the world' largest underground storage facilities. Just a lonely blue triangle - the logo of Iron Mountain Inc. bolted to a rock in the middle of nowhere.

Armed guards are stationed at the top of the entrance to the limestone mine shaft, which is protected by a slalom course of concrete barriers. More guards are at the bottom behind an 18 tonne steel gate. Cameras and camera-phones are confiscated.

The 150 Iron Mountain workers here cannot enter the mine more than 15 minutes before the shift begins or linger longer than that at the end. Everyone goes through metal detectors and is searched. Two sets of identification are needed.

"We are hyper sensitive about security," says Ken Rubin, Iron Mountain's senior vice-president of marketing. "It adds to the 'James Bond' factor."

The new climate of stricter corporate governance rules in the United States, Canada and Europe has meant companies must store information,including e-mails, for much longer periods and have them available quickly for scrutiny by regulatory agencies such as the U.S. Securities & Exchange Commission.

This has spurred a huge new market for such companies as Iron Mountain and its main rival, Atlanta based Recall Corp., which store articles and information that can be retrieved easily.

This former mine is Iron Mountain's main storage facility - an abandoned limestone mine 220 feet beneath the treed western Pennsylvania landscape. The company does not want the location revealed for security reasons.

About 130 acres of the 1,000-acre mine have been developed into the ultimate high-tech storage facility. Behind the eight-inch steel doors and concrete block walls in thr 800-foot-long catacombs are many of America's historic treasures and sensitive data.

Most of the major movie studios keep their original films here, like The Wizard of Oz of the Harry Potter films. Music studios keep the master recordings by the likes of Frank Sinatra and other icons here.

"There is a half million cubic feet of film here," says Tom Roth, Iron Mountain's vice-president incharge of the limestone mine. "That's the equivalent of 20 three bedroom homes filled from floor to ceiling." Modern films stored under the proper conditions that exist at IronMountain will last as long as 1,000 years.

There is much more in the 1.8-million-square-foot facility. Although the Boston based company is loath to talk about its clients, there is a wide scope of material.

The U.S. Social Security administration, according to reports, has every application filed by an American since 1937 in storage. And the U.S. Patent and Trademark Office has five million trademarks under lock and key, including one 34-S-2F filed by John D.Howard on Jan 2, 1858 for the Red Delicious apple.

Hospitals store tiny bits of human material used in pathology, mostly to protect themselves from future lawsuits. Mnay counties from the deep south to the Canadian border keep up to 200 year old records of birth, deaths and land deeds here.

Iron Mountain

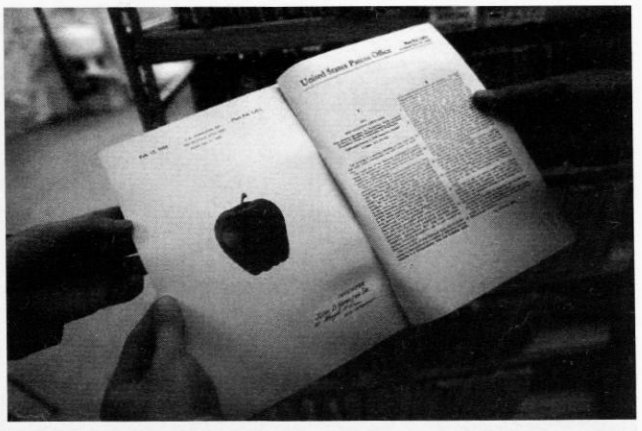
In room 19-N-IF the tributes by school children to doomed Flight 93 that crashed in Somerset County on Sept. 11, 2001, sit, awaiting a final home.

It is here that Microsoft Corp. chairman Bill Gates keeps his collection of 18 million photographs and images, which he licences through his Orbis company. The mine itself is much more than catacombs of storage facilities for things that will likely never see the light of day again. Besides Iron Mountain's 150 employees, another 1,550 people work in the mine on stored material - for film companies, the U.S. Government and several companies that will digitize images for clients. Many of the workers are ferried around the mine in yellow school buses.

The mine, with its 20 miles of roads capable of handling semi-trailers, is a city unto itself. It has independent power supplies, a five-acre underground lake for water, the capacity to move items at high speed through the vast network of shafts, and enough food and generating capacity to last seven days in an emergency.
"Even from the begining, this has been a very-self sufficient operation," says Mr. Roth, leaving the the boardroom that was once rigged to be an executive fallout shelter designed to withstand an atomic blast.

The vast facility is just part of Iron Mountain's storage facilities. It is widely seen as the world's leader in storage and management of sensitive data and items.

Its 14,500 employees run 800 storage and shredding sites, both above and below round, sites in the United States, Canada, Europe and Latin-America. For as little as US$3 per box a year, Iron Mountain will collect and store paper, film, audio recordings and e-mails.



This is the original patent for the Red Delicious apple, located in the U.S. Patent offices vaults at Iron Mountain, Pennsylvania. Image: © *James Leynse/CORBIS*

Once owned by U.S. Steel Corp., the Pennsylvannia mine was abandoned after it became cheaper to strip mine for the lime used in steel production. It was bought by an entrepreneur who used it to store U.S. Steel documents. The company got its start in 1951 when Herman Knaust went looking for a cool place to grow mushrooms. He ended up buying an ore mine named
Iron Mountain in upstate New York that he eventually converted to document storage. He called the company Iron Mountain Atomic Storage Corp.

The current Iron Mountain company bought the mine from him in 1975 and kept the name. It acquired the second, much larger mine in Pennsylvania 20 years later.

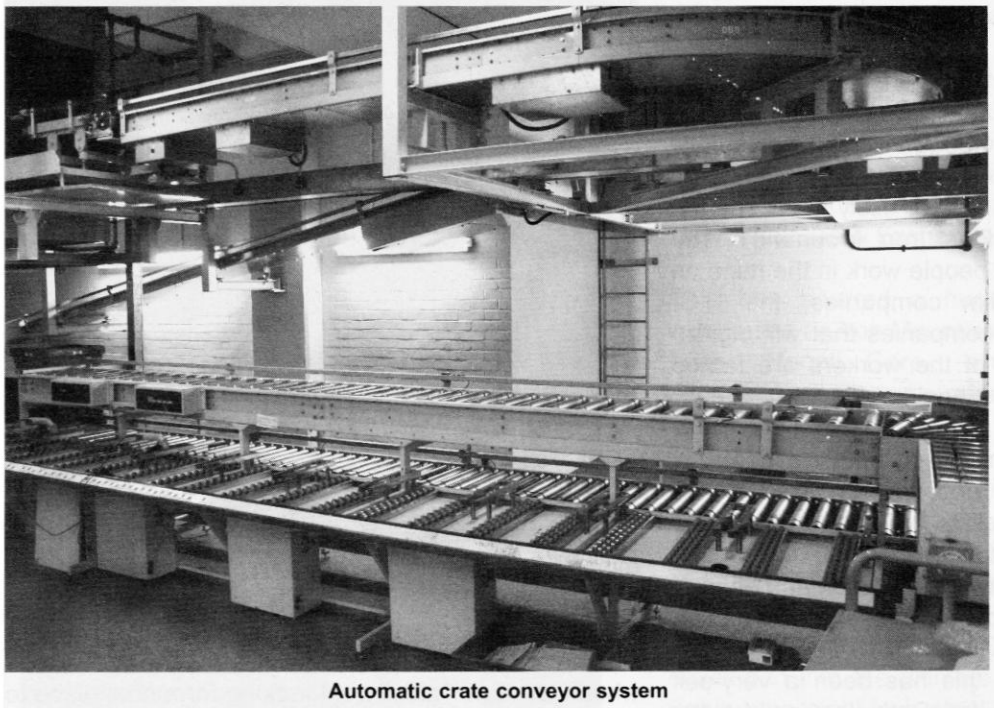
From Jon Five - Original Article by Peter Morton

The interior of the Corbis Film Preservation Facility, located in Iron Mountain underground storage facility in Pennsylvania. The 10,000-square-foot Corbis facility houses over 13 million photographic negatives, engravings and prints. The optimal storage conditions -- below zero degrees Fahrenheit and low humidity -- will ensure that the historically valuable collection will last hundreds of years, while remaining readily accessible. The move was necessary due to the high level of deterioration of the material, which includes the Bettmann collection and the UPI archives.

Image: © James Leynse CORBIS

British Library - Basements

VISIT TO THE BRITISH LIBRARY AT ST PANCRAS, LONDON - THURSDAY 14TH APRIL 2005



Automatic crate conveyor system

6 members of Sub Brit visited the BL basements in a visit arranged by Sarah Jenner, who works in the Conservation Department.

After signing into the building we started off at the model in the foyer for a bit of 'orientation' - the building was constructed 1982-1997 at a cost of £M 516 as a replacement for and amalgamation of 17 other sites - principally that at the British Museum. Only half the site had been developed in a first phase, of which half was a large open 'piazza' fronting the Euston Road. Wholly under this, and extending somewhat under the building, were five basement levels housing plant and book stacks, B4 being 23m (75ft) below ground. The BL receives 13km of legal copyright deposit per year and these existing stacks were now virtually full - a new low oxygen depository was being built in an industrial unit at Boston Spa. It should be noted that the Northern and Victoria Line go east-west under the site at about this depth. The basements were built downwards under an umbrella slab while the main building was being built upwards on top - the same technique used for Westminster Station/Portcullis House.

After signing into the basements, we took a lift to B2, a typical book stack floor. A central 'retrievals area' was a loading/unloading station for the automatic crate conveyor system which snaked everywhere through the exposed ceiling void, with points and vertical drops, and red crates trundling magically along automatically routed to the correct destination anywhere in the building by a bar code and scanner system, where they were loaded onto trolleys for onward dispatch.

Adjoining the retrievals area was a 'Section Room' for staff. This was an attractively decorated relaxation area for staff requiring to work underground.

Surrounding both were seven fire compartments of book stacks, each separated by double roller shutters with fusible links - mainly containing very high capacity rolling shelves. Some areas, for more valuable pre 1850 books, were within locked wire mesh cages, whilst the priceless books were in two high security vaults.

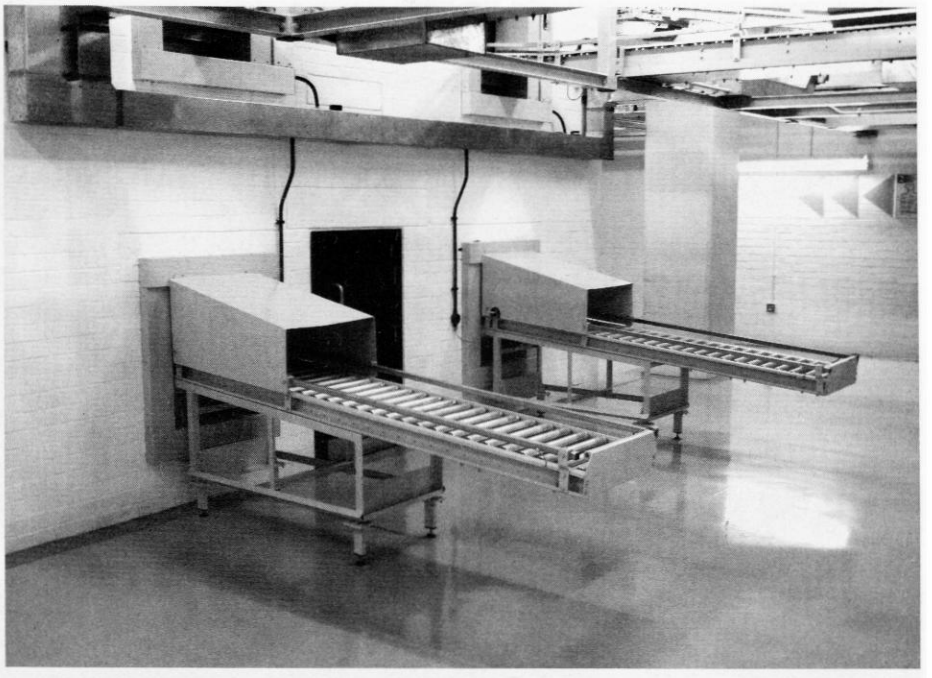
Fire protection had originally been planned to be a dry sprinkler system, where the water was held back by a pressurised gas so that when a sprinkler was triggered the gas escaped first providing a delay of a minute or two before the water appeared. Because of this the smoke detectors were at three times the density required by the British Standard, but eventually the delay was held to be unacceptable and a conventional instant wet system was reverted to. The security vaults were controlled to 16-18 degrees C and 40-55 % RH, with an 'Inergen' gas fire protection system which was automatically locked off as someone entered. We descended to B4, the lowest accessible level, which was similar to B2, but were intrigued by oblique references to B5, where no one could go as it was classed as a H&S 'Confined Space' full of 'Foul Water' and required breathing apparatus and special training to enter, after being forced ventilated for 24 hours.

Neither of our guides had been down there and they didn't know what it was for or how big it was - we persuaded them to show us the only door, which was anonymously at the back of a plant room hidden behind control gear disguised as for 'Foul Water Pump' and 'Ground Water Pump'.

We were only confirmed in our 'Tube Station to Box

British Library - Basements

and the Strategic Reserve' supposition! (Perusing the bookshop upstairs afterwards I found in 'The Design and Construction of the BL' by the architect Colin St John Wilson, a photograph of a model of the vertical construction. This showed the whole basement was underlain by a half height space above the final lowest concrete slab, presumably in effect a huge sump as an absolute assurance that the lowest stack would be dry).



Loading and unloading point for the automatic crate conveyor system.

We then ascended to B1, which had 3 small book stack compartments, but was principally plant. Throughout there were large hatches in the ceiling. There were 2 'small' plant rooms containing chillers and boilers, and three 'large' ones with the A/C plant. The appellations 'small' and 'large' were relative - the small ones were huge, and the large ones were gargantuan, stretching as far as the eye could see - we had never seen such huge and complex plant rooms, they were truly awesome. Just planning them must have been an heroic task. There were also five 11kv substations (with 110v site power points - a neat reduction factor of 100!), and two LEB substations.

There then followed a confusing walk involving climbing up a few feet to a passage
which then dropped back down to the tank farm. No explanation was offered for this curious feature, but it certainly looked like one was going over something.

The Tank Farm was, you guessed it, full of water tanks (unfortunately no one knew the total capacity, but it was big) - dual use for the sprinklers and the domestic water supply to the rest of the building, the sprinklers taking priority. There were no tanks in the roof; the water was all pumped from here. There was a stupendous water softening plant with a salt tank about 4m in diameter and 6m high which took 14 tons a month.

Finally we ascended to B 1/2, which existed as a series of isolated mezzanines. Here were half height 'undercrofts' under the surrounding pavements, and the odd door into light wells in the piazza. The standby generator room contained two diesel sets supplied by 'AutoDiesels', each consisting of a Dorman 649 HP engine and a Newage Stamford 560KvA generator. Starting by 18 Alcad cells. One had done 759 hours and the other 335 hours. They exhausted into a large well in the piazza near the Newton Statue. We then exited into the piazza via a door behind the coffee shop, much to the surprise of the public!

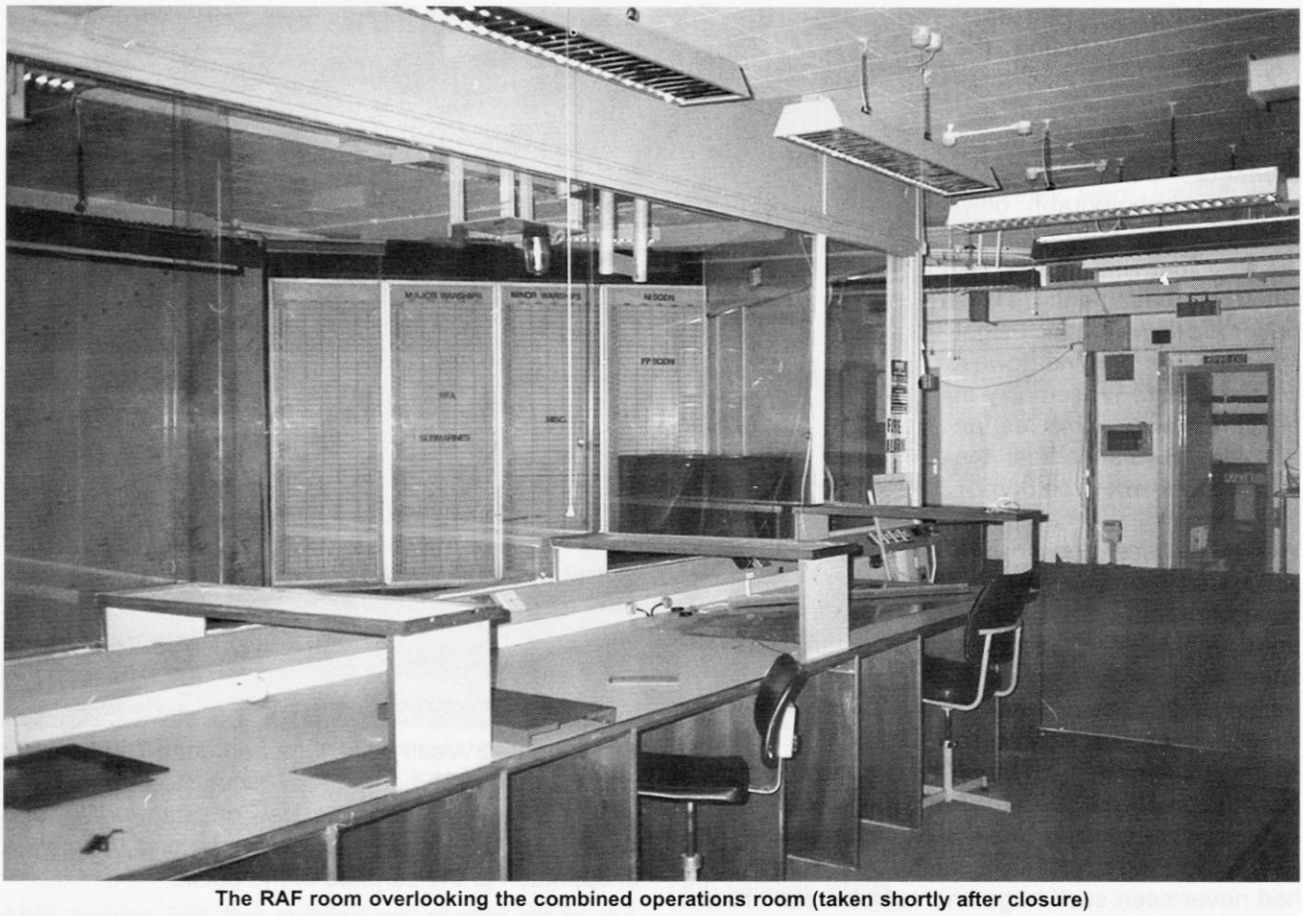
A short walk across the piazza and we entered an anonymous door to the right of the main entrance and descended down to the Security Control Centre in another B 1/2 island. This consisted of a self contained suite of main control room, kitchen, and battery backup room. The control room console had about 20 computers and TV monitors covering - Fire Alarm and Detection, with zoomable plans showing detectors and sprinklers; Radio Pager control; CCTV controlling 150 colour cameras with zoomable plans, video motion detection and digital recording kept for 31 days; Internal Alarm System and Swipe Card Access Control; and the Public Address System. There were feeds from the CCTV at the Woolwich and Micawber Street outstations, and from Colindale and Boston Spa. We exited down into B1 again by another anonymous staircase.

Finally, as a non subterranean bonus, we ascended the lift up the centre of the 6 storey free standing central atrium glass monolith of the King's Library book stack.

All in all a very interesting visit - thanks to Bob & Sarah Jenner for organising; and Tom Moulton and Roy Alston who conducted us around

Text By Roger Morgan Photo's By Nick Catford

Pitreavie Maritime Headquarters



The RAF room overlooking the combined operations room (taken shortly after closure)

Before the outbreak of WW 2 it was realised that protected accommodation would be required for certain vital headquarters.

As a result the RAF searched for a site for a Coastal Command Group HQ in the vicinity of Rosyth naval base. A rundown Scottish fortified house, Pitreavie Castle was found and subsequently purchased from the estate of Mr Henry Beverage for the princely sum of £12,306-00d to be the underground HQ for No 18 (Reconnaissance) Group, RAF Coastal Command.

On 14 April 1939 the Admiralty, desiring to move the Flag Officer, Rosyth ashore, approached the Air Ministry with a view to creating a permanent Area Combined HQ in the underground facilities currently being built. This was subsequently agreed with the RAF remaining as the lead service. The ACHQ was completed during 1941.

The now extended Castle provided accommodation for the Group HQ and the Air Officer, Commanding and a joint service Officer's Mess. The nearby stable block became a Sergeant's Mess whilst a large hutted camp sprung up for Officer's, NCO's and other ranks/ratings (both male and female) sleeping needs.

The Air Officer, Commanding. (AOC) No 18 (Reconnaissance) Group was responsible for maritime operations from Flamborough Head in Yorkshire, round the north of Scotland, including the Orkneys and Shetlands to Gairloch on the west coast inclusive of the Hebrides, whilst the Flag Officer, Rosyth was responsible for naval operations from Wick, in Caithness down to Flamborough Head. The remaining part of 18 Groups area was the responsibility of the Admiral Commanding, Orkneys and Shetlands.

The underground HQ consisted of a square, 2 storied structure, 20 feet underground with a double concrete burster cap over the top floor, this outline can still be seen on the grass below the Castle today. There were two entrances to the complex entering on the top floor, one to the west for RAF personnel and one to the east for the Navy (Yes, really), an emergency exit is located on the lower floor. The central Operations Room on the top floor (38 feet x 28 feet) is 13 feet high and projects 3 feet above the rest of the block. A 3 foot high platform has 3 glass fronted cabins, one for each of the services along one wall. Apart from staff offices the majority of the accommodation is taken up by communications equipment for the RAF, Navy and GPO. The Army had very limited presence or space.

Pitreavie Maritime Headquarters

The combined operations room (taken shortly after closure)

Following the end of WW 2 the Maritime HQ continued to function although the Flag Officer, Rosyth became the Flag Officer, Scotland.

In 1949 NATO was formed and both of the Naval and Air Commanders became double hated with NATO appointments.

In 1958 RNR HQ Unit formed at MHQ Pitreavie. The name HMS Scotia was adopted in 1960. During 1962 HMS Scotia moved out of the underground MHQ to an above ground building. On 15th May 1996 upon the closure of Pitreavie HMS Scotia relocated to new quarters within the nearby HMS Caledonia.

During 1962 both Flag Officer Scotland and Air Officer Scotland assumed responsibility for Northern Ireland and added NI to their respective titles.

On 30 April 1968 RAF Strike Command was created from Fighter and Bomber Commands at High Wycombe with Coastal Command becoming No 18 (Maritime) Group headquartered at Northwood outside London. The old No 18(R) Group now became the Northern Maritime Air Region; still at Pitreavie (the Southern Maritime Air Region was located at Mount Batten in Plymouth)

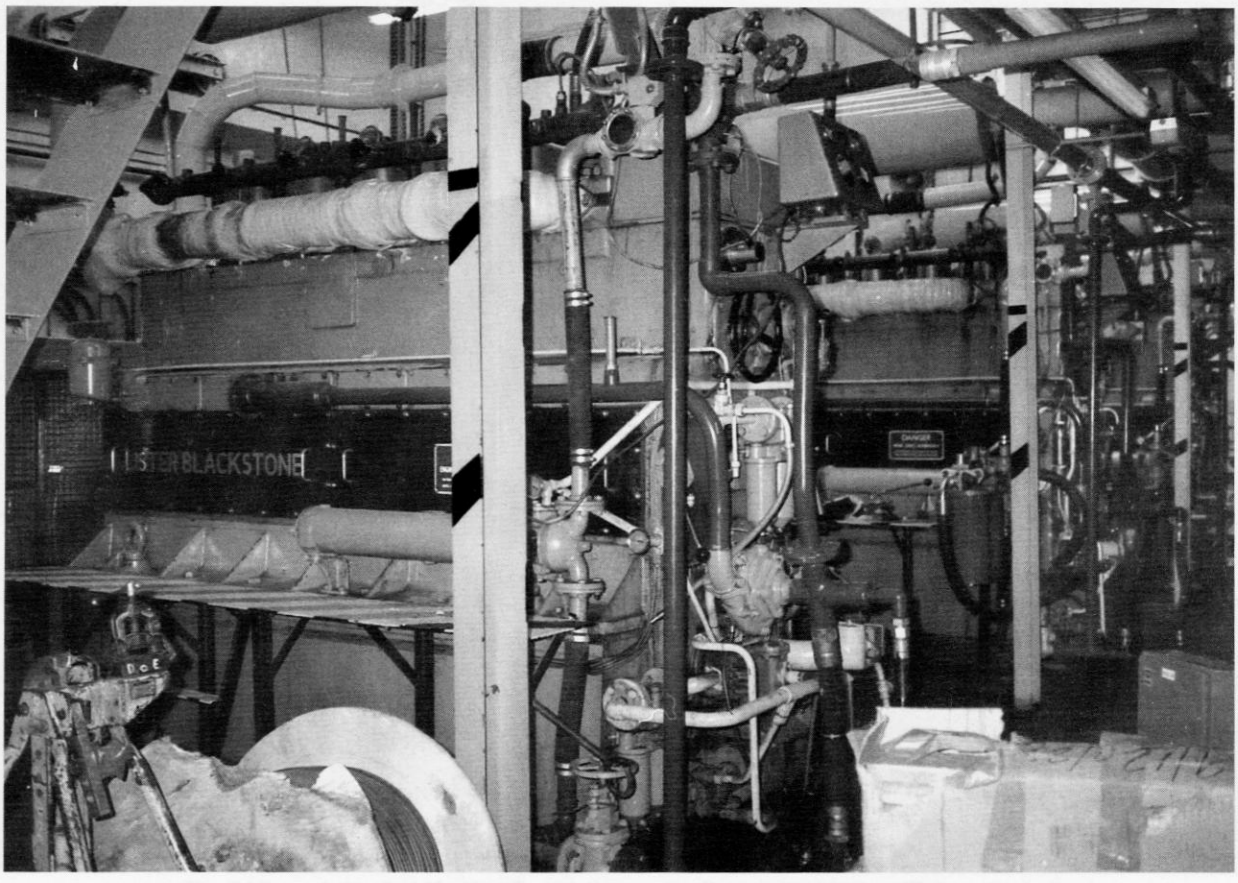
During this period the underground bunker underwent modernisation, but details of the extent of the improvements and whether it entailed any structural alterations are unknown.

By 1984, the RAF commitments at Pitreavie were reduced to housing the Rescue Co-ordination Centre (RCC) (North) a function at the HQ since WW 2, support for the AOSNI who was still located there and to running the NATO Integrated Communications System Terminal and Relay Equipment (NICS TARE) The Navy continued to undertake FOSNI's commitments.

In 1993 a NATO review relieved the AOSNI of his NATO hat, whilst in June it was announced that the two RCC's, North at Pitreavie and South at Mount Wise/Mount Batten were to be combined at Pitreavie. In the event a new Aeronautical Rescue Co-ordination Centre (ARCC) was opened in 1994 at RAF Kinloss from where it is still currently operating.

The Maritime Rescue Co-ordination Service is currently a commitment of HM Coast Guard. with centres around the coast of the UK working in conjunction with the RNLI.

Pitreavie Maritime Headquarters



The Standby generators (taken shortly after closure)

Pitreavie Castle in May 2005 - now converted into luxury apartments

Pitreavie Maritime Headquarters

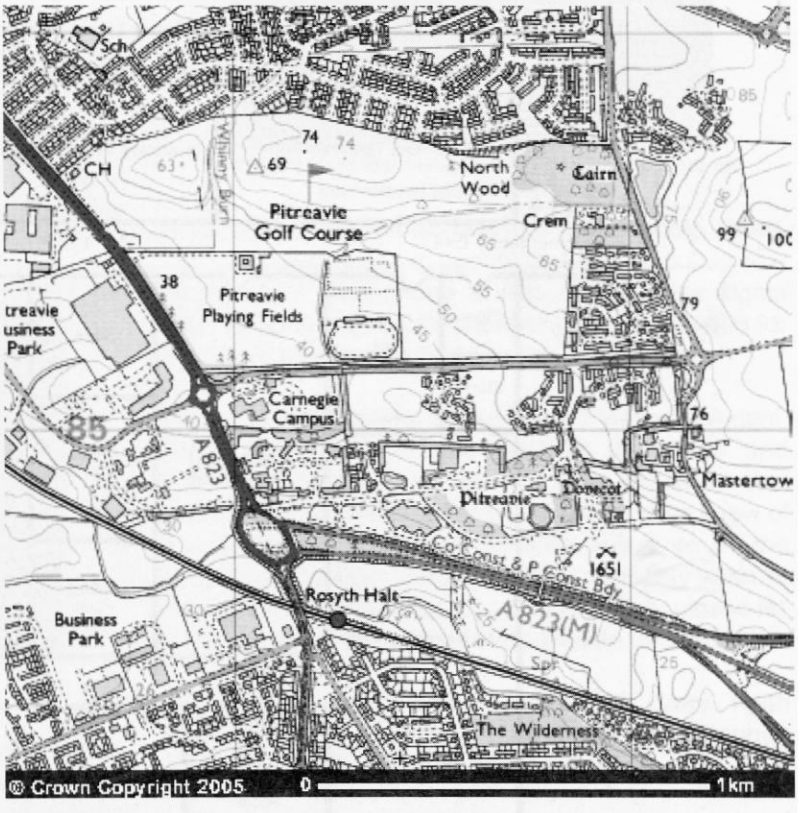
The aerial photograph shows the castle in the middle of the wooded area with the hutted camp to the south

1994 saw FOSNI transfer his Flag to the Naval Base at Faslane and in December AOSNI moved to RAF Leuchars, with the closure of NICS TARE, now surplus to requirements, the end was inevitable, closing on the 1st February 1996 after 55 years of continuous service.

After being cleared, the site was sold, with the bunker having all entrances completely sealed and all surface traces (apart from a footprint) obliterated. The Castle had all of the RAF additions removed and has been converted into very desirable apartments as has the adjacent Stable Block. The rest of the site has been tastefully landscaped with a new housing estate to the north of the Castle and a large Industrial Estate to the south.

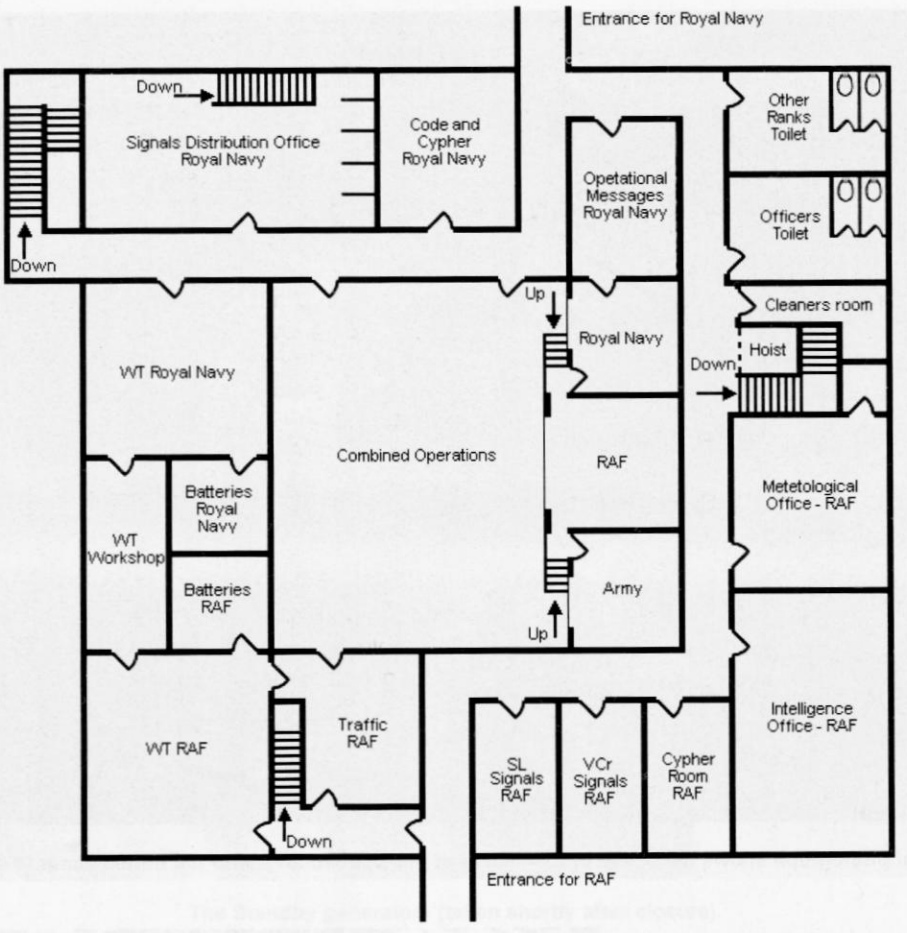
The site has apparently only the two buildings mentioned remaining although the road layout is still intact, assisting in locating the bunker, which with great regret was not entered.

Bob Jenner 2005

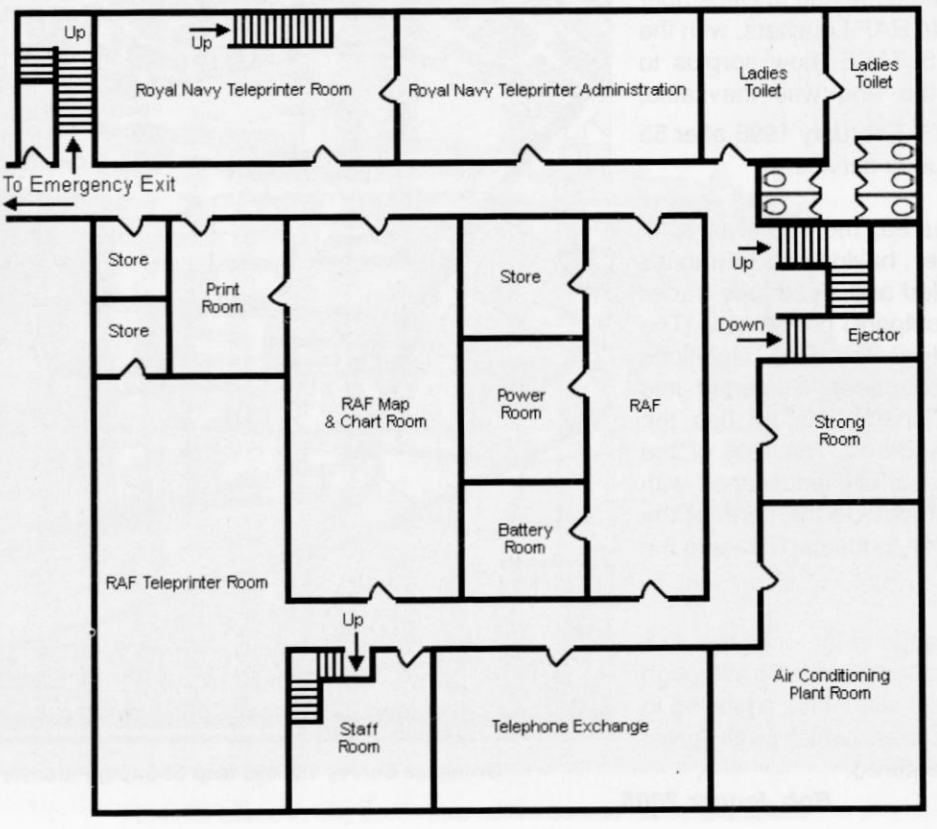


Ordnance Survey 1:25000 Map Showing Pitreavie Castle

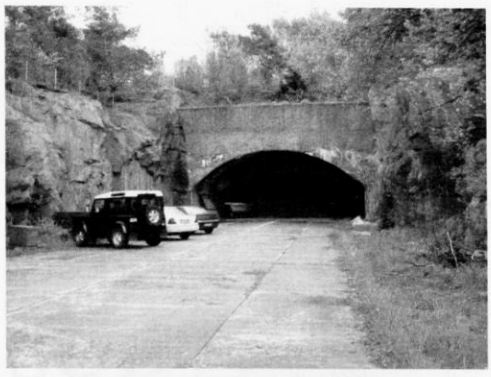
Pitreavie Maritime Headquarters



Pitreavie Castle - Bunker Floor Plan Upper Level (Above) and Lower Level (Below)



Aeroseum



Entrance to original WW2 Hangers

On Wednesday 18th May eight Subbrit members caught the early flight from Stansted to Gothenburg City Airport in Sweden to visit Aeroseum which is very conveniently situated at the airport. Gothenburg City Airport is a disused military airport which has two underground hangers, one dating from 1940 the other from 1955. The Aeroseum is a museum in its early stages of development which will be housed in the 1955 hanger. We were shown around both the hangers and the underground fuel store.

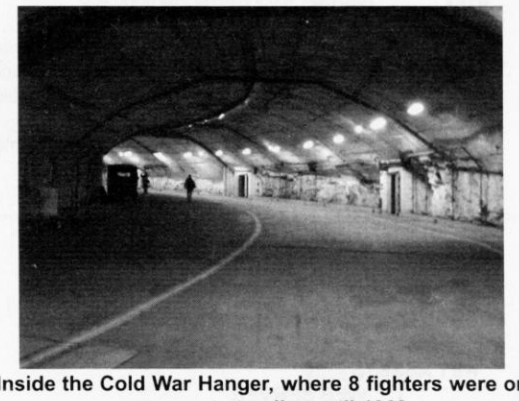
Work on the first underground hanger started in 1940 and it was fullyoperational by 1943 being occupied by 3 squadrons each with 20 aircraft. It was constructed in a rocky hillside adjacent to the airfield and has a total internal area of about 6000 sq m. Access is by one of four large entrances which are connected inside by a network of "aircraft sized" tunnels. Standby power was provided by a diesel generator from a submarine which is still in situ. With the advent of nuclear weapons it was realised that this hanger had insufficient protection so a second one was built about a kilometre away in another rocky hillside. This was completed in 1955 and stayed operational until 1969 when it was closed by government cutbacks. It was of a similar size to the

Inside the WWII hanger

earlier one but built much deeper into the hillside and protected by 90 ton concrete sliding doors. The doors opened out into a cavern with two exits, turning left the aircraft could access the runway while turning right they could join the motorway network and use that for take off if the runway had been damaged. During its period of operation eight fighter aircraft were lined up behind the doors ready-to-go. The first in the line could be airborne in 2 minutes. It was equipped with two diesel generators and had a hardened ground control room from where the station commander would manage the aircraft movements until they took off.

Finally, by a stroke of luck, the keyholder of the underground fuel storage facility was on site and we were asked if we would like to see it. What a question to ask a group of Subbritters! This is accessed via a small gas tight door in the hillside and down a network of stairs and tunnels. It consists of two enormous fuel tanks holding 2.6 million gallons of fuel between them in a large chamber hewn out of the rock about 20-30 metres below the surface.

The 1955 hanger is being turned into a "living" museum and the curators are keen that visitors should be able to not only touch but to get into the exhibits. Our guides insisted that we all stood on the wing of one



Inside the Cold War Hanger, where 8 fighters were on permanent standby until 1969.

of the fighter aircraft to have our group photo taken. The Aeroseum hopes to opento the general public next spring and I recommend a visit. Our Ryanair flights were 1p each way, so it's cheaper to get to Sweden for the day than to most places in the UK by train!

We were very grateful to our guides Hans Blomdahl, Roger Elliasson and Ake Hall for their time and patience in showing us around. They did make one request for information which is, "Does anyone know of any underground aircraft facilities anywhere in the world that precede 1940?" They're obviously keen to know if theirs is the first. If you know of any please let me know and I will pass the information on to them.

The eight Subbrit members were Bob Clary, Keith Ward, John Smiles, John Shere, Stuart Wild, Stephen Underwood, Robin Cherry, and Nick Pedley.

Pictures and Text From Bob Clary

Subterranea Britannica Treasurers Summary Report 2004

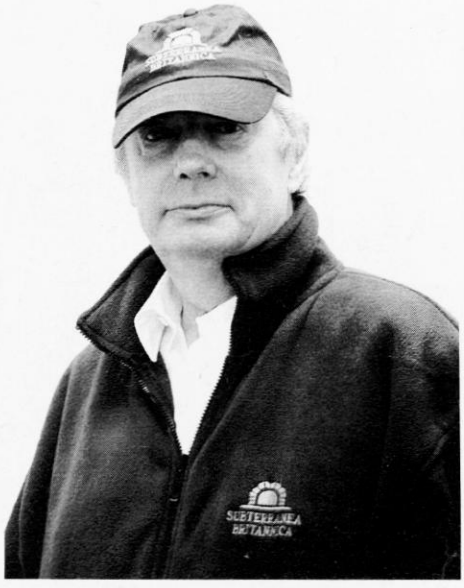
From **1 January 2004** to **31 December 2004**

		Year ended 31 Dec 2004	Year ended 31 Dec 2003
INCOME/EXPENSE			
INCOME			
	Membership Subscriptions	11,812.44	11,417.50
	Publications	24.02	29.00
	Donations	90.00	-
TOTAL INCOME		11,926.46	11,446.50
EXPENSES			
	Affiliation Fees	121.00	141.00
	Bank Charges	11.50	-
	Paypal Charges	39.39	-
	Insurance	2,100.00	135.00
	Miscellaneous expenses	40.50	46.50
	Post, Packing & Staty, Phone & Copying	2,576.21	1,569.60
	Printing	11,358.20	3,219.53
	Publicity Items	843.38	-
	Computer Equipment	-	990.21
	AV purchase	-	482.24
	Web Fees	810.85	-
	Depreciation - Web Server	291.79	-
TOTAL EXPENSES		18,192.82	6,584.08
SELF-FINANCING ACTIVITIES			
	Income from Conferences	4,401.00	2,282.50
	Outgoings from Conferences	(3,751.46)	(1,569.85)
	Income from Study Weekend	4,344.50	4,688.00
	Outgoings from Study Weekend	(4,072.94)	(3,923.93)
	Income from other Events	2045.00	-
	Outgoings from other Events	(1682.94)	-
TOTAL SELF-FINANCING		1,283.16	1,476.72
TOTAL INCOME/EXPENSE		(4,983.20)	6,339.14
BROUGHT FORWARD		15,625.02	9,285.88
ACCUMULATED INCOME		10,641.82	15,625.02
NET ASSETS			
WEB SERVER			
	At Cost	875.37	-
	Less: Depreciation	(291.79)	-
		583.58	-
CASH			
	Unity Trust Bank	13,427.05	12,317.19
	Paypal	254.03	-
	GiroBank	1,994.65	1,994.65
	Cash Floats	1.00	1,014.68
PAYMENTS IN ADVANCE			
	Spring Conference Deposit	465.00	502.50
	Autumn Conference Deposit & Expense	56.00	-
DEBTORS			
	Conference & Study Weekend fees Due	34.00	-
RECEIPTS IN ADVANCE			
	Subscriptions	(763.42)	(204.00)
CREDITORS			
	Printing	(5,021.50)	-
	Web Fees	(387.85)	-
	Expense Account Balance	(0.72)	-
TOTAL		10,641.82	15,625.02

Sue Monsell, Treasurer (2004) **31st July, 2005**

SUBTERRANEA SHOP - PRICE LIST AND ORDER FORM

SUBTERRANEA BRITANNICA



All items are in Navy Blue with the Subterranea Britannica logo and name in light blue.

Item	Size	Price	Qty
'Fruit of the Loom' Sweatshirt	S-36" M-38" L-40 to 42" XL-44 to 46" XXL-48"	£20.95	.....
Cotton polo shirt	S-36" M-38" L-40 to 42" XL-44 to 46" XXL-48"	£18.95	.....
Lambs wool V neck sweater	S-36/38" M-40/42" L-44" XL-46/48"	£39.95	.....
Baseball cap, unlined	One size fits all	£8.95	.....
Boiler suit	S M L XL	£31.95	.....
Full zip fleece	S M L XL XXL	£28.95	.....
Total purchases	**Value**	**£ .....**	

Name:.....

Address:.....

.....

.....Post code:.....

Telephone number:.....

Please debit my credit card: Visa/MasterCard

Number.....

Expiry date.....

Signature.....

Postage and packing will be added at cost.

If you prefer to pay by Cheque, please telephone first to obtain postage and packaging cost. Other items are available on request, please telephone for a quotation

Please photocopy and return this order form direct to;

Rainbow Copy & Embroidery Services, Bath Road, Lymington, Hampshire SO41 3RW
Tel/Fax 01590 673 186 e-mail: sales@rainbowcopy.co.uk